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POP200/300
Observation Payload

User's Guide

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Terms and Abbreviations

A

AGC	-	Automatic Gain Control
AS	-	Auto-Scan
AZ	-	Azimuth

B

BH	-	Black-Hot

C

CFG	-	Configuration.
CG	-	Cage.

D

DC	-	Direct Current
DTV	-	Day Television

E

EL	-	Elevation
ELZM	-	Electronic Zoom
ETI	-	Elapsed Time Indicator
EXP	-	Exposure

F

FLIR	-	Forward Looking Infra-Red
FOR	-	Field of Regard
FOV	-	Field of View
FT	-	Force Transducer.
FZ	-	Freeze

G

G/L	-	Gain/Level
GN	-	Gain.

H

HB	-	Hot Black
H/W	-	Hardware
HC	-	Host Controller
HCG	-	Hand Control Grip
HH	-	Heading Hold

I

ID	-	Inner Diameter
INRT	-	Inertial
IP	-	Inertial Position
IR	-	Infra-Red
IRC	-	IR Camera
IT	-	Integration Time

L

LOS	-	Line of Sight.
LPS	-	Laser pointer sensor.
LRF	-	Laser Range finder

M

MFOV	-	Medium FOV
MFS	-	Multi-Function Scale

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Terms and Abbreviations (Cont'd)

N

NAV	-	Navigation
NFOV	-	Narrow FOV
NIR	-	Near IR
NUC	-	Non-Uniformity Correction

O

OD	-	Outer Diameter
O-level	-	Organizational Maintenance Level

P

PLT	-	Plate
POP	-	Plug-in Optronic Payload
PP	-	Present Position.
PRI	-	Priority
PSU	-	Power supply unit

R

RDR	-	Radar
RG	-	Range Gates

S

S/W	-	Software
SHTR	-	Shutter.
SINI	-	Slice Initialization.
SLV	-	Slave
SNAR	-	Super narrow (FOV)
STBY	-	Stand-By
STD	-	Standard

T

TBL	-	Table
TINI	-	Turret Initialization.
TOD	-	Time of Day
TRCK	-	Track
TRT	-	Turret
TV	-	Television

V

VCR	-	Video Cassette Recorder

W

WH	-	White-Hot
WFOV	-	Wide Field of View

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1 Introduction

This document describes the operation and guidelines for proper use of the POP200/300, POP200-6, (enhanced DTV), POP200P (with LP) and POP200TS/300TS (Three sensors), optronic payloads. Read this manual carefully in order to get the most out of the product. If you have any question or require assistance, please call TAMAM customer service department. This document contains also important safety instructions and operation information on the POP200P, which contains a non-eye safe laser pointer (LP) sensor.

Appendix A provides field level maintenance instructions and on-site troubleshooting for the payload. It contains the required guidelines to maintain the payload at the organizational ("O") maintenance level.

A separate chapter is dedicated to the enhanced Day TV channel, which characterizes the POP200-6 and POP300.

✖ Safety Note:

A POP200P and POP300 version contains a Laser Pointer Sensor (LPS). When this sensor is active, and points toward a human eye, it may cause a permanent damage to the eye.

If the payload that you have purchased contains the LPS, than read first carefully the safety instruction at chapter 6.2 in this manual.

1.1 Application

This manual is for POP200 or POP300 units with software versions as follows:

Turret: #11 or higher.
Slice: #15 or higher.

As of August 2004 the latest SW versions are: Turret #11 and Slice #15.
Also the following SW version is available:

- Turret #12 and Slice #16.
- Turret #13 and Slice #17.

This manual covers also the operation of additional POP200/300 sensors and features which are optional:

- Laser Range finder (LRF).
- Laser pointer Sensor (LPS)
- Enhanced DTV channel (POP200-6)
- Payload integration with NAV/RADAR.
- Payload operation with dual HCGs.

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1.2 General Description and Background.

The POP200 optronic payload is comprises of two assemblies:

- **Slice:** Contains the sensors, cameras, and there optics (also referred to as "slice").
- **Turret:** Used as line of sight (LOS) stabilization, orientation and as the mechanical interface between the optronic unit and for the carrying platform.

Each assembly is a self-contained and is an independent unit with its own power supply and a controller (microprocessor + software) for management and communication with each other or with an external controller.

Each assembly is operated by:

- 28VDC nominal input operation voltage (22 VDC ÷ 32VDC).
- Bi-directional communication channel for transfer of information and commands to/from the unit and the **HCG** or a **Host Controller**.
- Output of video lines from the slice to the turret and from the turret to the monitor.

Common practice to control the payload is by using a dedicated **Hand Control Grip** (HCG), which simulates the host controller serial commands stream. The HCG contains the required hot key to access the payload commands and controls (see Figure 1-2). (Please note that the HCG is an optional deliverable device to the POP200).

Figures 1-1 and 1-2 shows the payload main subassemblies. Figure 1-4 depicts the POP200 architecture.

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System principle of operation is as follows:

a. The 28 VDC operating voltage is fed directly to the turret. The system is still in the OFF position since the ON/OFF signal from the host or the HCG to the power supply in the turret is not active.

b. When the ON signal becomes active (low), power is applied to the turret, which then feed it to the slice, and the payload becomes active.

c. The host transmits the STBY command (or the HCG switch is set to STBY), setting the system to standby mode.

d. The turret power supply activates the power supplies in the optronic unit (and in the HCG if applicable). Communication is established between the two subassemblies and the host controller.

The turret verifies that the communication among the three elements: (a) turret, (b) slice and (c) HCG/host is OK. If so, the optronic unit activates the video signals and the turret activates the line of sight (LOS) stabilization system and LOS movements control. Once a pushbutton on the HCG is pressed, its proper command to the turret or slice is activated.

1.3 Operating Voltage.

The nominal operation voltage is +28 VDC, which is received from an external power supply. If the Payload is installed in a considerable long distance from the driving power supply source (several tens of meters), there is a voltages drop of several volts on the operation cable, causing the voltage received at the Payload terminals to be lower than the voltage output by the power supply. In such cases, the power supply output voltage should be trimmed to be higher than the nominal, typically 32 volts.

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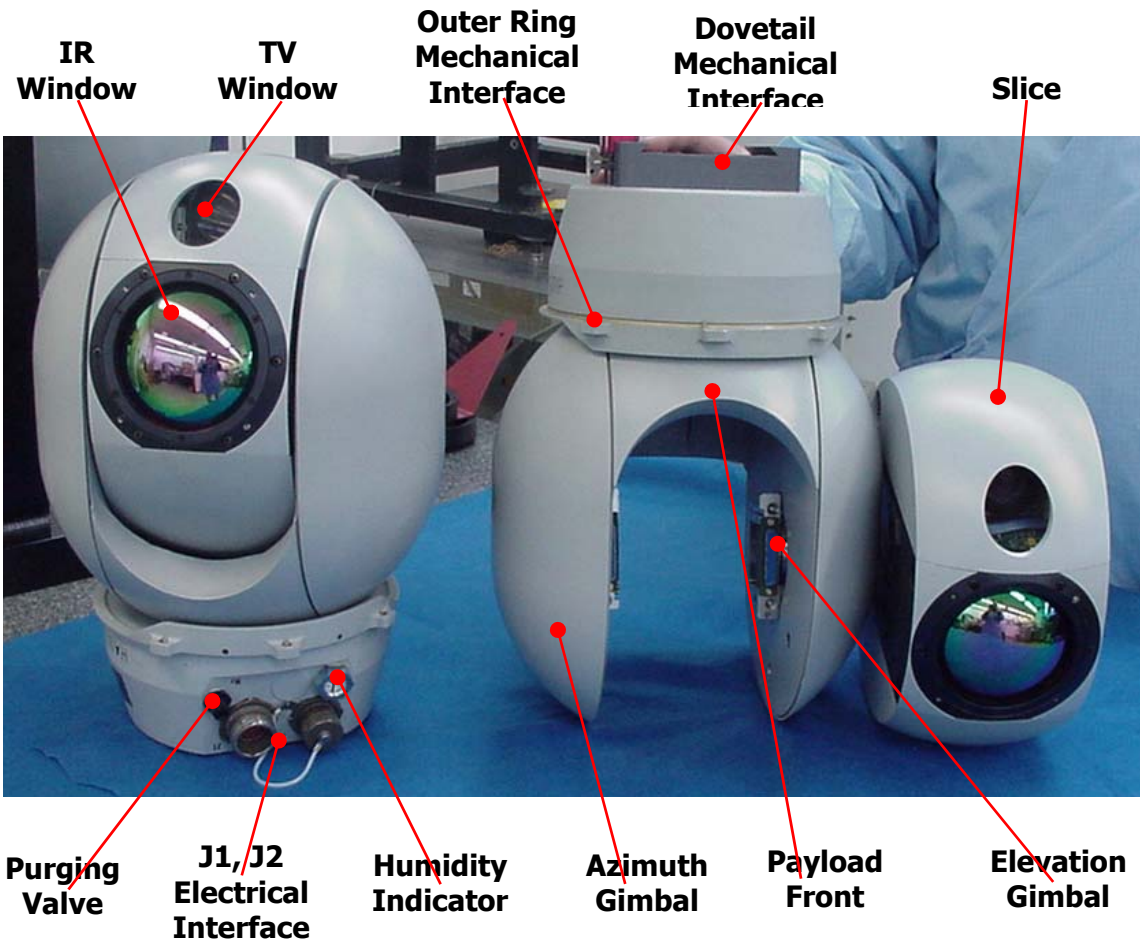

Figure 1-1. POP200 Optronic Payload - Main Components

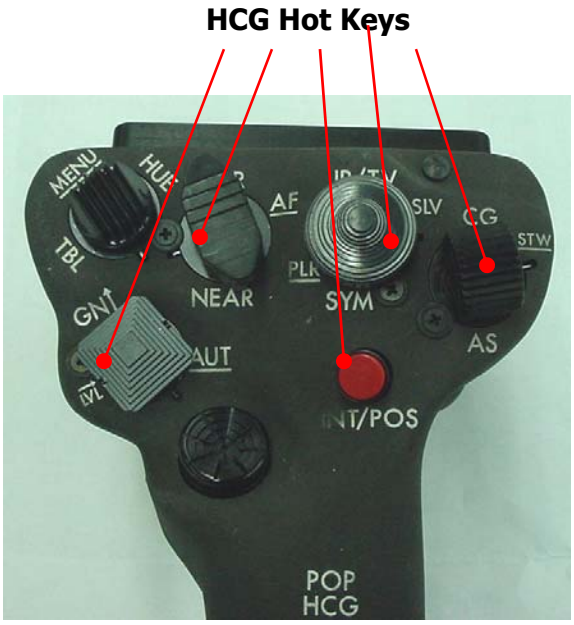

Figure 1-2. Hand Control Grip (HCG) for POP200

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1.4 General Installation Guidelines

When installing the payload in the laboratory or anywhere else – for operation, make sure that you follow the following guidelines:

- Always use a **stiff mechanical stand** to mount the payload.
- Secure the payload to the carrying vehicle or stand, via the dovetail interface or the six screws outer ring (M4).
- Always connect the electrical connectors **before applying power**.
- Check carefully for proper connection of the input power polarity.
- Before applying power to the unit **remove** the FLIR window cover (**red cover**).
- When operating the payload make sure external objects do not obscure its LOS, even partially.
- Verify that appropriate metal cover (supplied with the payload) always protects the TEST connector (J2).
- The payload is delivered in a mobile, reusable container. When not installed on board, always **keep the payload in its original container** (see Figure 1-3).

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Figure 1-3. POP200 Original Container

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1.5 Functional Block Diagram

Figure 1-4 below, depicts the system functional block diagram. Note the connection of the VCR and the Monitor. (Monitor, VCR, cables and HCG are not part of the basic deliverable system). The product highlights (technical characteristics - see Figure 1-5) may be displayed through the display MENU option on the ABOUT.

Also a list of main features of the DTV and FLIR can be found at appendix C.

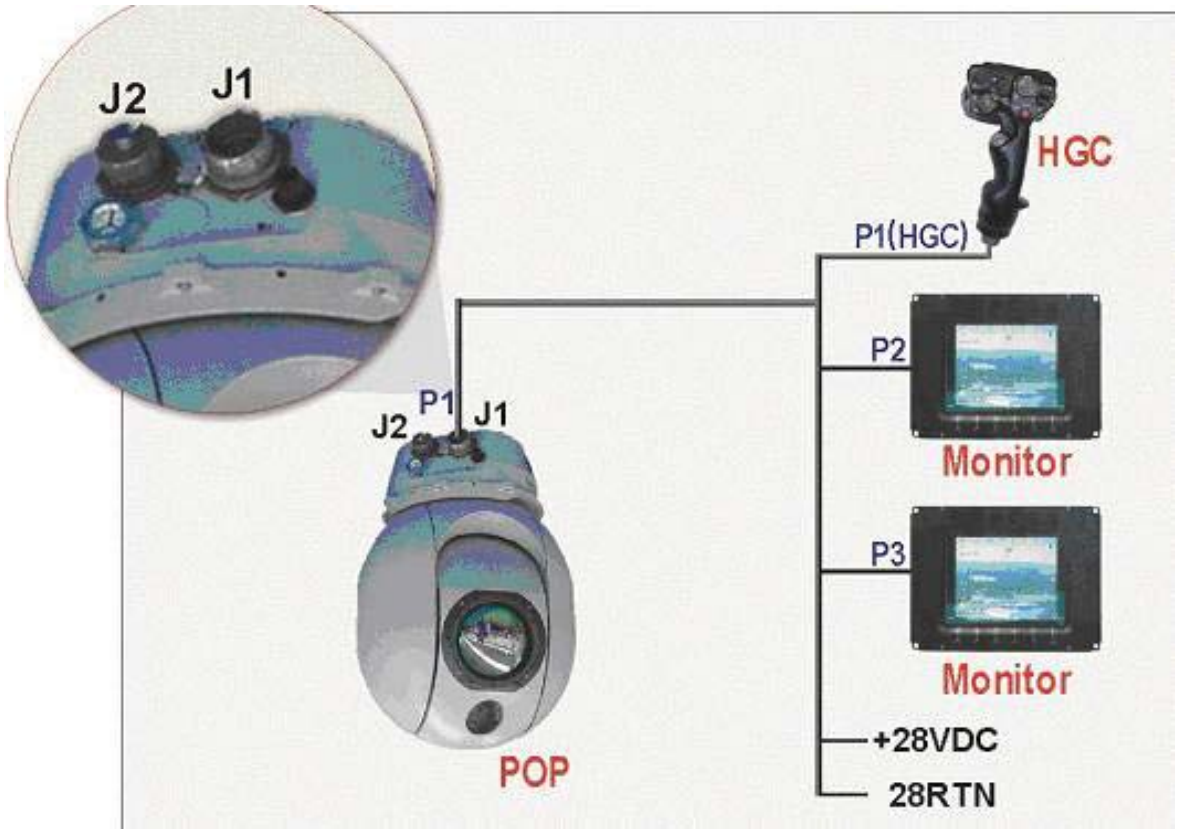

Figure 1-4. POP200 Optronic Payload - Functional Block Diagram

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1.6 POP200 Operation Guidelines

The payload may be operated and driven using one of two alternatives:

a. **Using the HCG**. In this case the HCG realizes the POP200 uplink protocol. The HCG contains a micro-controller, which converts the user depressions on the switches into a serial bus stream.

b. **Using a standard PC or host controller**. For this alternative needs a communication port and special POP200 application software, which emulates the HCG, which run on a PC (When using a standard PC COM, a RS232/RS422 converter is required).

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POP200 DEVELOPED & PRODUCED
BY IAI-TAMAM
IR MAIN FEATURES:
DET: INSB 320*240, BAND 3-5,
COOL DOWN TIME LESS THAN 6 MIN
FOV: WIDE 22,MED 7,NAR 1.7,SNAR .85 DEG
AGC: AUTO, MAN, DYNAMIC WINDOW
NUC: 2 POINTS EXTERNAL OR INTERNAL
TV MAIN FEATURES:
DET: COLOR CCD 1/4"
FOV: OPTICAL 27/1.7, ELZM 1.7/0.85 DEG
FOCUS: AUTO, MANUAL
MODES OF OPERATION:
INERTIAL: LOS IS INERTIAL
POSITION: LOS IS INERTIAL AND
TRACKS BODY POSITION
STOW: FOR SAFE OFF MODE
NUC: BUILD IN 3 FACTORY TABLES
USER NUC: CAN BE CREATED UPON
USER REQUEST
TRACK: TRACKS ON A CONTRAST POINT OF
THE SCENE (OPTION)
LOS RATE: FOV DEPENDENT 60 DEG/SEC MAX
+45
-135
El= -0.6
+180
Az= 25.4

Figure 1-5. POP 200 Highlight Characteristics

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2 Payload Operation.

2.1 Connections and Initial Operation.

The payload may be connected to the carrying platform in several ways, depending on the payload application and usage. Typical connection describes in appendix B. However ,when the payload is integrated with RADAR or GPS, other configuration may be used.

2.1.1 Connections

The payload has one operational (signal) connector, **J1**. Use a standard POP200 Operating cable, see appendix B (optionally supplied by TAMAM), or use the drawing at appendix B to build a proper cable for yourself.

Make sure for the following connections:

a. Before any connection is made, turn your PSU to ON and read its output voltage. Make sure it is 22 to 32 VDC, not above. Turn power off.

b. Power leads to the 28VDC supply. Before any connection is made, identify clearly the polarity leads of the payload input power operating cable.

c. Repeat this check for your driving PSU. Failing to connect the leads power in the proper polarity may cause damage to the payload.

d. **Only after the above steps, complete the connections:**

e. Prime video output to one monitor (or VCR).

f. J2 connector to the HCG or to host controller via J2 mating connector.

g. While the HCG ON/OFF switch is in OFF state, turn ON the 28VDC power and see zero current.

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2.1.2 Initial Operation

ON-OFF switch

Amber Light

If power is applied properly to the system, the HCG amber light will light with **orange**. (when the HCG is still in the OFF position).

Set the ON/OFF switch on the HCG to STBY. Wait one second and then set it to ON. When using a Host Controller (HC), transmit the standby command to the payload via the serial link.

After 60 seconds, the amber light on the HCG will turn **green**.

If the payload uses a dual HCG application, than only one HCG, typically the primary HCG will be able to turn ON or OFF the payload.

> **Important:**
>
> If the power supply which drives the payload, contains a current consumption display (the +28VDC current), verify that the current consumption during activation of the system does not exceed 5A (Also see that its current limit switch will not limit you).

For a fraction of a second after applying power, the current consumption reaches of a peak of 8A. During the first few minutes of operation (FLIR cooler is operating in full rate), the current consumption is up to 4A. After approximately 4 to 8 minutes the current stabilizes around 3A.

The system can be shutdown at any time, regardless of the operation mode. Reactivation of the system shall be done after a period of at least 30 seconds. This period is required in order to enable the gyro to sufficiently slow down, to prevent a high "feedback voltage" that may occur if the system is activated again.

> **Warning**
>
> Wait at least 30 seconds, between shutdown and re-applying power to the system.

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2.2 Image Reception and Selection.

2.2.1 Image Reception

After about half a minute, a FLIR initialization image appears (see Figure 2-1) on the monitor. The image is composed of gray hues screen and the **SINI** legend appears. The image changes to FLIR real image after 4-5 minutes (when the detector is cooled-down).

The DTV image is received immediately. The default for the output video on the prime channel output is the FLIR. However, once the slice **SINI** legend is cleared, you may select the TV to be the prime video output, at any time. This is done by pressing the sensor mode pushbutton on the HCG, up, IR/TV (or by sending the proper command via the payload uplink.

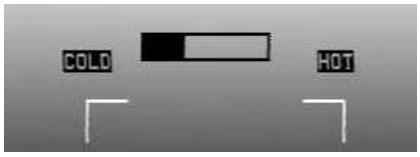
IR/TV Select switch

After receiving the first snap of FLIR image, wait another 2 minutes until receiving an optimal FLIR image.

> **⌦ Note**
>
> **During at least 6 minutes of system operation, a background audio noise typical for a cooler is heard. Afterward it becomes quiet.**

During the IR detector cool-down period, an indication bar appears on the image and indicates the cool-down process convergence temperature of the FLIR. When the detector reaches its operating temperatures, (typically 77 - 80°K) the indication disappears.

During FLIR cool-down period, the prime video output channel may be switched to TV and a TV image may be displayed.



Cool down FLIR bar

Note: You may have FLIR Initialization image and cool down bar still decreasing and the legend SINI gone away.

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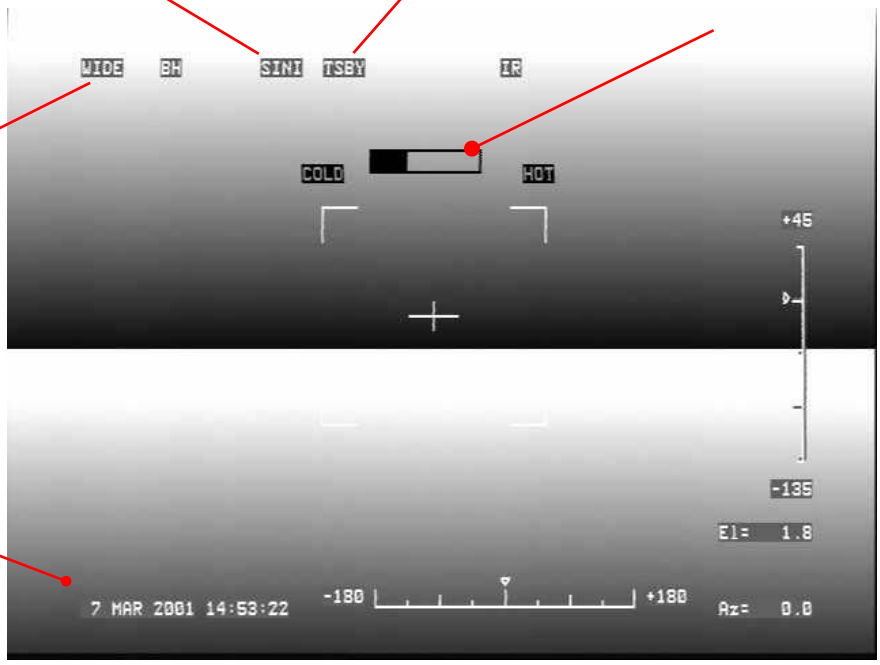

Figure 2-1. FLIR Initialization Image

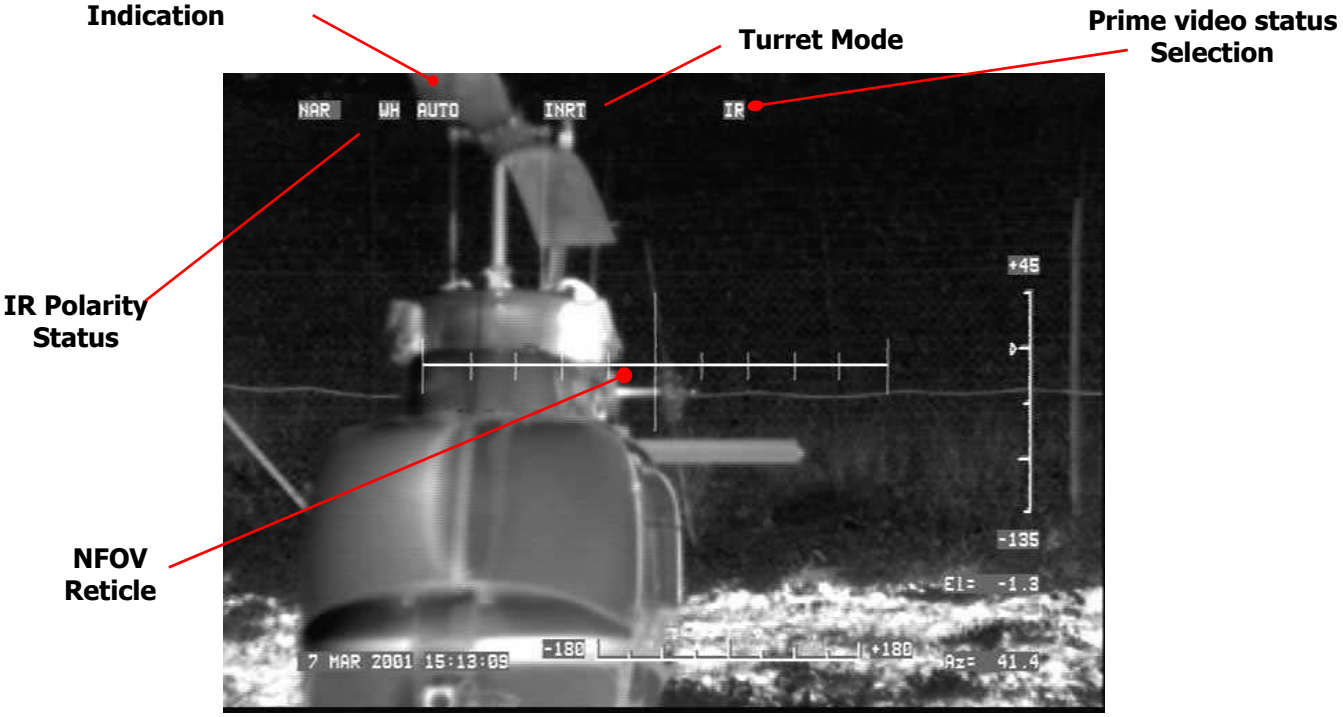

Figure 2-2. IR/TV Indication

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2.2.2 Display

The system has two independent video outputs, one for each sensor. Each output is available on J1 output connector. Nevertheless, it is possible to operate and use the payload with one output and one monitor for displaying alternatively each of them. In this case, toggle between the TV or IR video sources to one video line output, by IR/TV pushbutton.

The wiring in the POP J1 connector and a typical POP200 interface cable installation supports the two video outputs, therefore it is recommended to connect the two video outputs into two monitors or to one monitor with a possibility of displaying two video signals from two outputs.

2.2.3 Video Outputs Logic

The system has two video outputs that can be displayed simultaneously on both monitors.

a. IR display (FLIR camera)

b. TV display (Day camera)

One output is defined as "main" (PRIME). The other output is defined as "secondary". It is possible to modify the sensors definition, main and secondary, between the two. The modification is done by sending the proper commands to the payload, or by pushing pressing the IR/TV button. (Toggle between TV and IR sensors as a prime).

On the TV monitor an indication appears, which represents the main video output channel in use (see Figure 2-2):

a. Main FLIR display: IR

b. Main TV display: TV

Meaning: in a given moment, it is possible to control only the characteristic of the sensor, which is defined as prime. Means, that if you want to change the FLIR field of view, verify that the IR symbol is displayed on the screen, you are in the FLIR display and the system cursors are superimposed on the FLIR image.

In POP applications having one video output, (one physical line) the pushbutton is used as the video source changer on the line, between the IR and the TV (when using one monitor).

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2.2.4 IR Image

The default prime image is FLIR. The system FLIR image at power up, has the following parameters: Non-uniformity correction (NUC) table #1, (with 2.0 milliseconds exposure time) which its indication on the screen is WARM. Figure 2-3 shows a typical IR image with the symbology.

The FLIR FOV is wide **WFOV** and its focus goes to the "infinity" point. (And so for every FOV providing it is the first swathing to that FOV).

2.2.5 TV Image

The default secondary video output is the TV. Switching to TV is possible also during the FLIR initialization process while the SINI indicator is still on the screen. The DTV goes to its last set zoom and looks for automatically for the focus. Figure 2-4 shows a typical TV image and its overlay symbology.

Note: If the payload is integrated with RADAR or GPS, and one or both of them is active, than additional data will appear on the image (See section 8):

Platform heading HDG

Platform Present Position PP

Time and day will be synchronized to the GPS. (unless the user has selected not to, via the MENU).

2.2.6 Controlling the Secondary video output.

The default secondary video output is the TV. You may set the secondary output, to be the same as the primary. The benefit is that one can have the video output with the payload symbology and at the same time a clean video for the user applications. Go the system menu, system configuration and select the line SECONDARY = PRIMARY.

Note that the status of this selection is stored in the system nonvolatile memory, for future operation – until next change.

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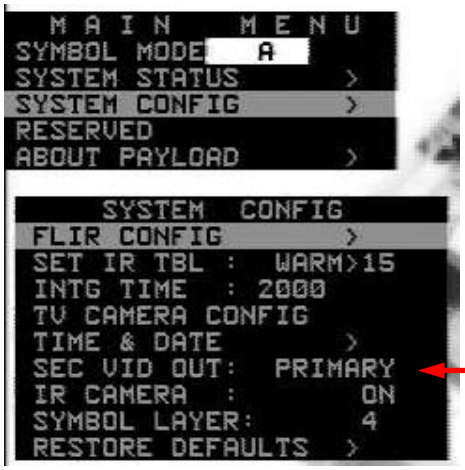

Select which video output will be displayed on the secondary video output

System default is that the secondary output is set to be the other video which is on the primary output.

2.3 System Shutdown.

Before system shuts down, it is recommended to bring the line of sight to STOW position to protect the FLIR lens. This position is +90° in elevation. Press on STOW shortly from any position. Wait until the system will reach to a position of +90° in elevation and 180° in azimuth (about 5 seconds). In this position, shut down the system.

This position is assigned to protect the camera window by hiding it.

Before any power restart, wait at least 30 seconds, after shut down.

✖ Caution!

Never disconnect the POP cables while its input power source is ON (active).

In case that the system is using the FLIR optical magnifier, than the STOW position will be +15° in elevation and backwards.

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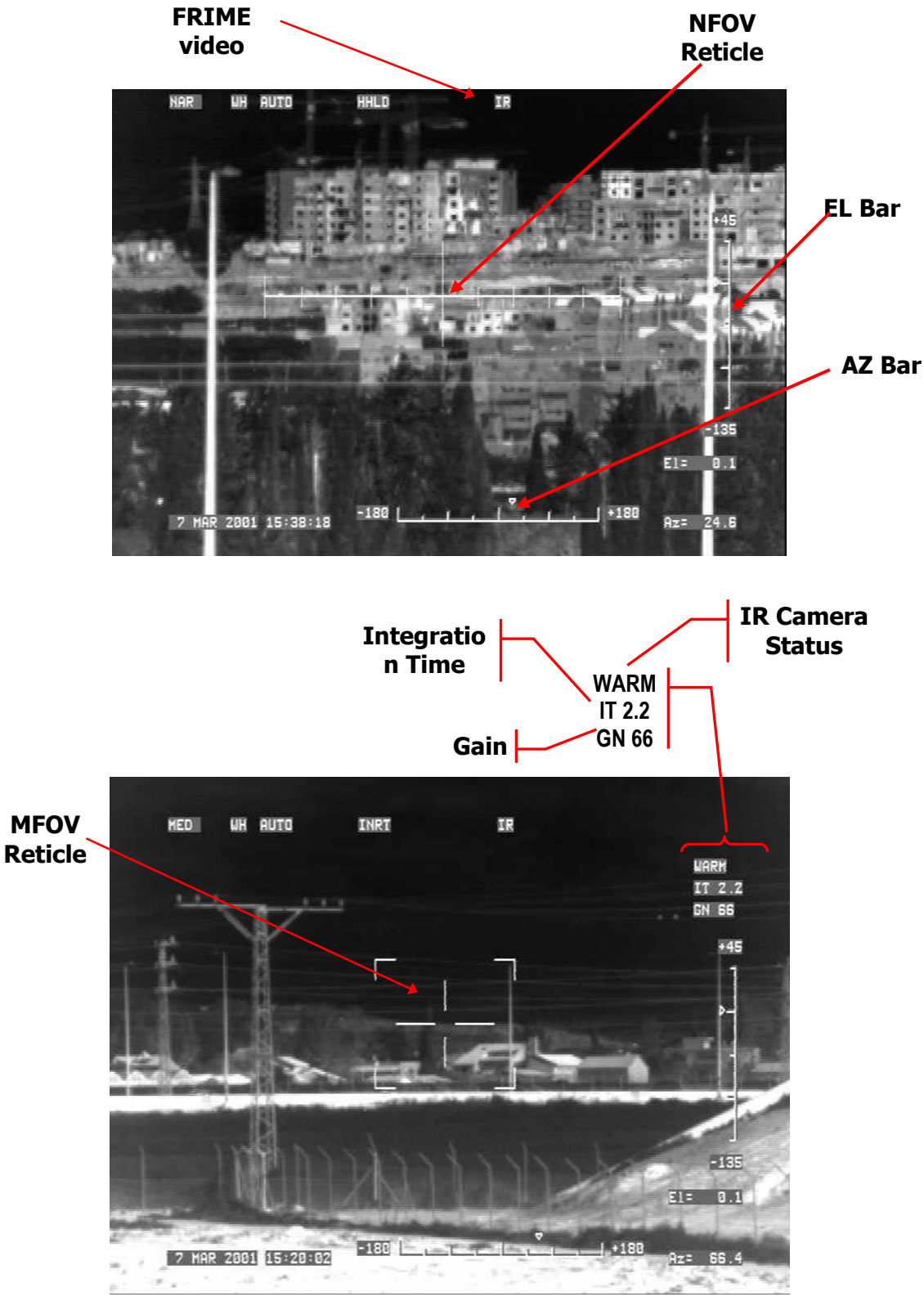

Figure 2-3. Typical IR Image

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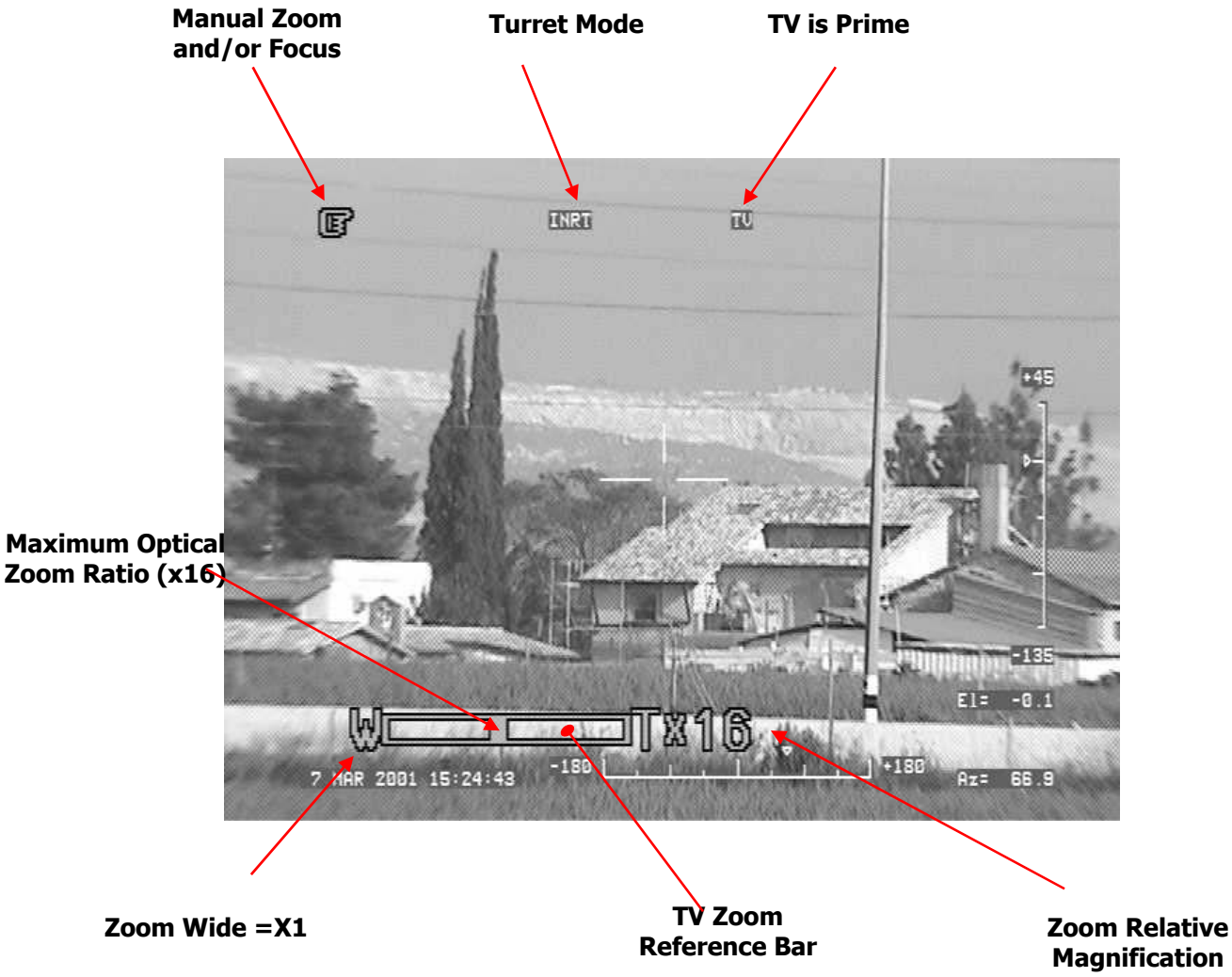

Figure 2-4. Typical TV Image

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2.4 Piloting (Slewing) the LOS.

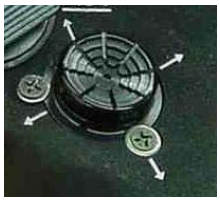
2.4.1 Line of Sight (LOS)

Inertial / Position toggle button

At the end of turret initialization, the legend **TINI** is cleared and the system enters **CAGE** mode. The LOS moves to a predefined direction with defaults values of 0° in azimuth and -7° in elevation (This is the default CAGE operator window, which can be set by the user to any value). In the CAGE mode, piloting the LOS is impossible. Switching to INERTIAL or POSITION operating mode enables slewing the LOS.

You may enter this mode by sending the proper commands to the payload or pressing INT/POS pushbutton on the HCG.

2.4.2 The Force Transducer (FT) Pushbutton



The Force Transducer Button.

System piloting (slewing the LOS) is performed by pushing the FORCE TRANSDUCER (FT) button on the HCG towards the desire direction, or by sending the proper rate commands via the serial link – to the payload.

The legend **INRT** or **HHLD** should appear on the turret status field.

Slewing the LOS is allowed at inertial or position turret modes. In order to slew the system's LOS, the FT button should be pushed to the right/left or up/down.

Light pressing = slow motion. As the pressure increases the Payload's line of sight motion is accelerated. When releasing the pushbutton, the line of sight remains in its last position. Notice that the LOS rate depends on the field of view. As the FOV goes narrower, the scanning velocity becomes slower. That is in order to create an effect of a homogenous image motion velocity.

The slew command is an analog command in the range of ±128 bits.

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2.4.3 Report on System Status and Position

The system turret status is reported on the image in the turret status field (upper center image).

LOS attitude in azimuth and elevation is reported in degrees and as a tick mark on the EL and AZ bars, plus the actual current reading of azimuth and elevation (see figures 3-1).

2.4.4 INERTIAL Mode

To enable LOS slew, the system should be set into INERTIAL or HEADING HOLD mode, by sending the proper commands via the serial link to the payload, or by pressing on INRT/POS switch, on the HCG, INRT is display.

The legend **INRT** is on the turret status field.

If LOS rate is not commanded, the LOS will remain in its last position, but may drift away slowly, according to the system natural drift.

When the system is calibrated, the drift is very slow and can be noticed only after a few minutes.

2.4.4.1 Stabilization

In inertial mode, the LOS is stabilized (compensated) against external mechanical disturbances. The LOS will point to an infinite point in the inertial space. Movement of the carrying vehicle will not affect this pointing and the image will appear stable on the display.

2.4.5 POSITION (Heading Hold) Mode

In Position mode the LOS is stabilized against external disturbances the same way as in the inertial mode. However the LOS will maintain its position fixed, relative to the carrying vehicle.

You may prevent the low drift, which may occur in the inertial mode, by changing to HEADING HOLD (HH) mode. **HHLD** is display.

The INRT/POS is a toggle switch.

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2.4.6 STOW Position

Stow (STW)

This state is designed to keep the FLIR window safe by erecting the line of sight upwards. Short press (less than 1 second) will bring the line of sight to elevation of +90°, (azimuth to -180°) ,from any position. **STOW** legend is on the screen. This position is maintained after system power down. A magnet "locks" the slice unit opposite to the turret.

Exit from STOW by pressing shortly the INRT pushbutton and the system reaches its last attitude before it was stowed, in azimuth and elevation.

For some users application, the magnet was removed and is not part of the product configuration.

⌦ Note:

To stow up the LOS, keep short pressing toward IN - on the turret mode pushbutton (STW). Long pressing will set the system into non-uniformity correction mode.

In case that the system is using the FLIR optical magnifier (POP200M), than the STOW position will be +15° in elevation and backwards.

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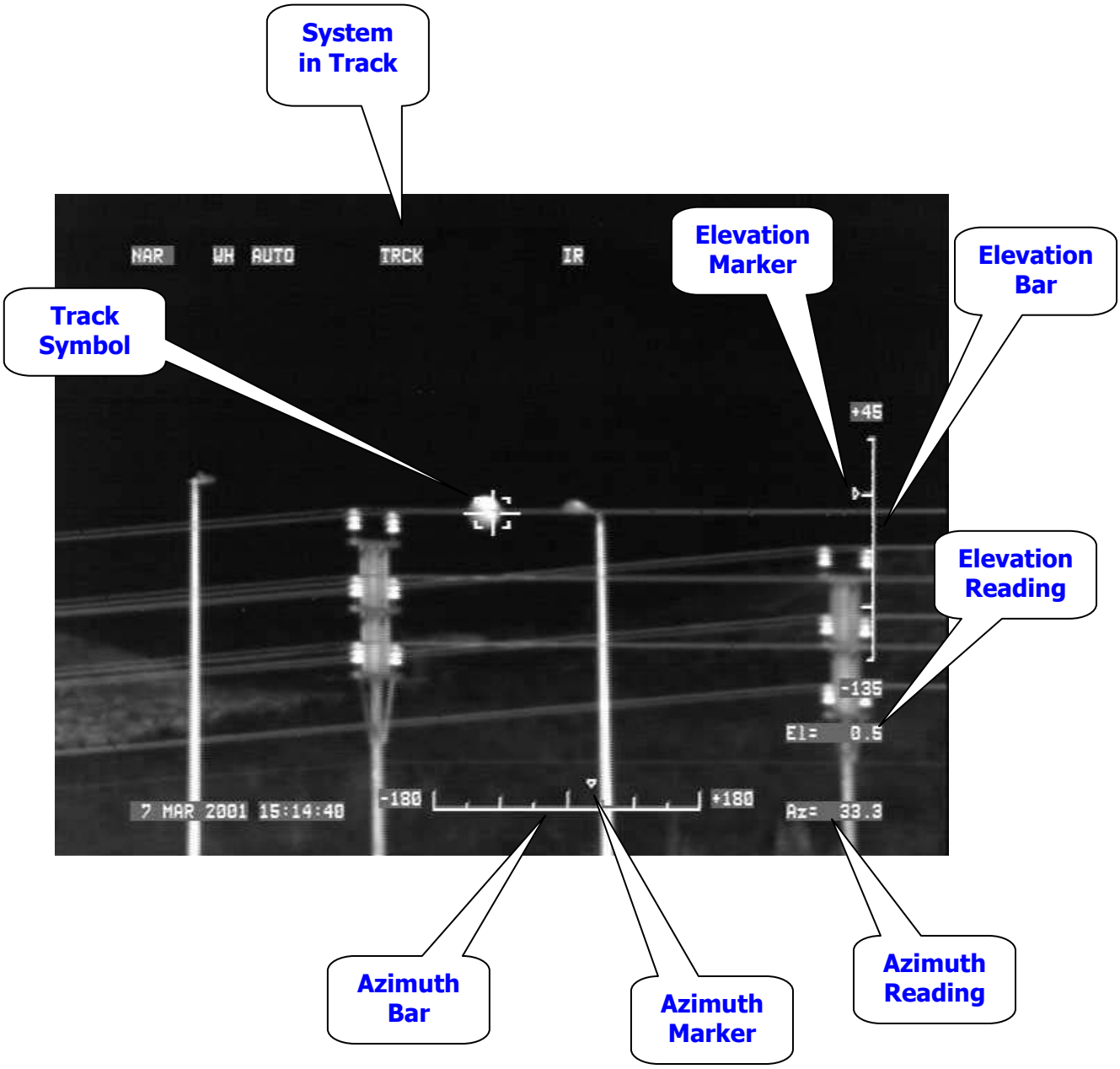

Figure 3-1. System and Attitude Reports

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2.4.7 AUTO SCAN

2.4.7.1 General Description

Auto Scan (AS)

The AUTO SCAN mode is designed for automatic scanning of an area sector. The scanning is a "window" scanning. The maximal scanning limits (maximal window) are 180° in azimuth and 90° in elevation.

Push the turret mode button down (AS) to enter **AS** mode. You may exit auto scan by forcing any other mode. Figure 4-1 describes a typical AutoScan pattern.

In AutoScan mode the LOS is stabilized against external disturbances the same way as in Inertial mode.

> **⌦ Note**
>
> **You may set the system to a very slow rate slew in order to get a good distinction of the object in the field of regard (FOR). Select the rate parameter as required during the configuration of the rate.**

2.4.7.2 Scanning Window and Velocity

The AS has a default (factory set) values of: ±20° in azimuth and ±20° in elevation (both around 0°). The user may alter these values, see next.

Changing the zoom of the camera or FOV of the FLIR, while scanning causes a change in scanning in such manner that the angular speed of the picture on the screen stays constants.

During the scan there is 30% overlap in the FOV of the pass, between each current pass of the scan and the previous pass of the scan. (pass = one snap of left to right movement).

2.4.7.3 AS Window Configuration

The following instruct the user how to configure and select a new the AS window.

a. Press the AS button for more than 3 seconds or rend the proper commands via the serial link, for more than 3 seconds. This will enter the system in AS configuration mode.

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b. **AS CFG** text appears.

c. Set first the upper right point of the scanned sector, using piloting commands - Up/Down Left/Right.

d. Press shortly on AS to store this point.

e. Set next the down left point of the scanned sector using the piloting pushbutton - bottom-right corner.

f. Press shortly on AS to store this point.

g. Determine the scanning velocity using the FT pushbutton upwards on downwards (high speed or low speed).

h. Press shortly on AS to accept this speed and to exit from CONFIG position.

> **⌦ Note:**
> **When referring here to buttons, it is also true for sending the proper commands via the serial link.**

The new set of, AS parameters are stored in the payload nonvolatile memory. It will be used as new default after power cycling.

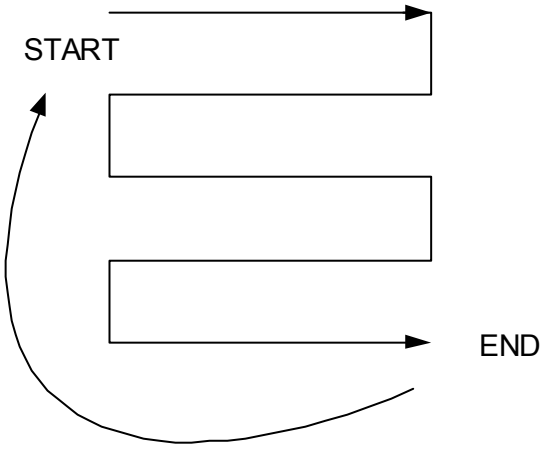

Figure 2-1. Autoscan Pattern

2.4.7.4 Exit from AS Mode.

Done by moving to any other working mode of the Payload: INERTIAL or POSITION or non-uniformity correction.

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2.4.8 Cage Mode (Operator Window)

2.4.8.1 General Description, single CAGE

When selecting this mode, the line of sight moves to a pre defined LOS direction, which is stored in the systems memory. The line of sight will not drift and will always point towards this point. The FT is disabled.

You may configure the system CAGE pointing, to another direction (see next). The CAGE pointing data is stored in the systems non-volatile memory. The default CAGE pointing (factory set) is AZ = 0°, elevation -7° with reference to the payload carrying plate.

Note: for some users application this value may be set at production, differently.

2.4.8.2 Using Operator Window Mode

Cage mode is used to bring the LOS at power up to a pre-known direction, or if, during normal usage; the operator is loosing orientation (usually in the narrow field) and wants to reach quickly to a known point.

2.4.8.3 Entering to Operator Window

Short press (less than 1 second) on the turret mode button, toward CG, or send the proper commands via the serial link, will bring the line of sight to operator window. **CAGE** legend appears on the image, in the system status area. In this mode all the controls of the DTV and FLIR are active as usual.

2.4.8.4 CAGE Position Configuration

The following instruct the user how to configure and select the CAGE to new pointing direction.

a. Press the turret mode button CG position, for more than 3 seconds, or send the proper commands via the serial link, for more than 3 seconds. This will enter the system in CAGE configuration mode.
b. CG CFG legend appears on the system status field.
c. Determine the new required point of LOS, using piloting commands (or HCG FT pushbutton) - Up/Down Left/Right.
d. Press shortly on CAGE.
e. The system exits CAGE CFG and new CG LOS is set.

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2.4.8.5 Exit from CAGE Mode

Done by moving to any other working mode of the Payload: INERTIAL or POSITION or non-uniformity correction.

2.4.8.6 Triple CAGE, General Description

In some applications, the system can be configured to support three CAGEs. The first time the user enters CG it will be CAGE-1. Any consecutive cage selection will roll the next cage, which is CAGE-2 and then CAGE-3. The next selection of cage will set the system to CAGE-1.

The default three CAGE pointing (factory set) with reference to the payload carrying plate are:

CAGE-1 AZ = 0°, elevation -7°

CAGE-2 AZ = +90°, elevation -7°

CAGE-3 AZ = -90°, elevation -7°

Each one of the three cages may be configured to a new pre-defined LOS.

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2.5 Track Mode

2.5.1 Description

The real time video tracking mode is available only if this feature is installed in the POP200 payload.

The video tracker processes the video signal output from the imaging sensor and calculates LOS angular error relative to target location. In TRACK mode these error signals are fed into the turret gimbals servo tracking loop witch nulls the tracking errors via the gyro torquer. Hence the LOS of the FLIR or the DTV is maintained on the target regardless of the carrying vehicle or the target motions.

In order to initiate video tracking, the target should have some contrast in its details. The tracker is locked onto this contrast. If this contrast is too weak, than track may be lost.

2.5.2 Tracker Submodes

The POP200 has basic track mode plus two track adjust modes. In addition if track is lost than prediction mode enables the tracker to relock if track is lost for few seconds.

- **Track:** If the tracker sense "enough" contrast of the image, it tracks this target. (Maintain the LOS in the center field of view of the image).
- **Adjust:** This mode enables the operator to move the target track gate along the target in order to track other points on the target.
- **Search:** This mode enables the operator to choose another target without loosing the current tracking target.

Figure 6-1 presents a typical track mode symbology. Note the track search.

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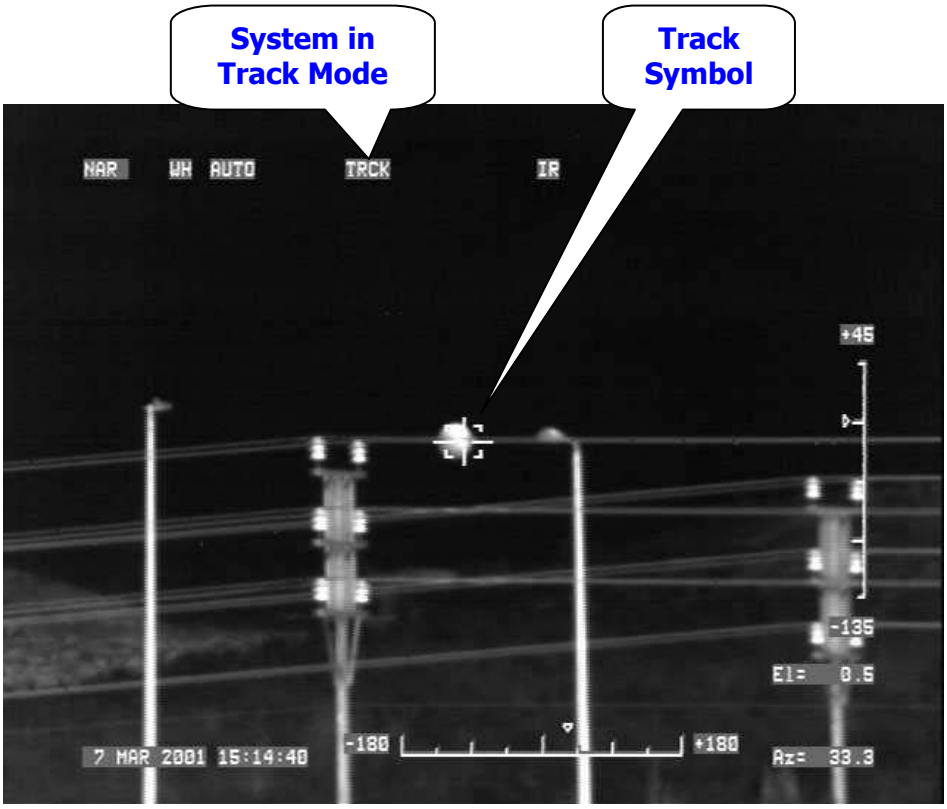

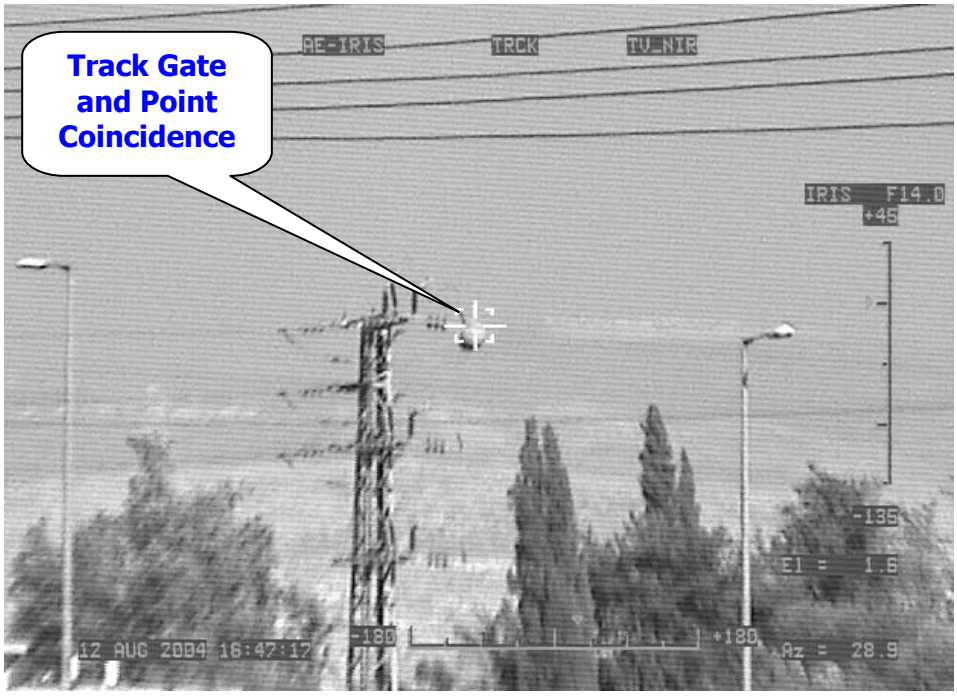

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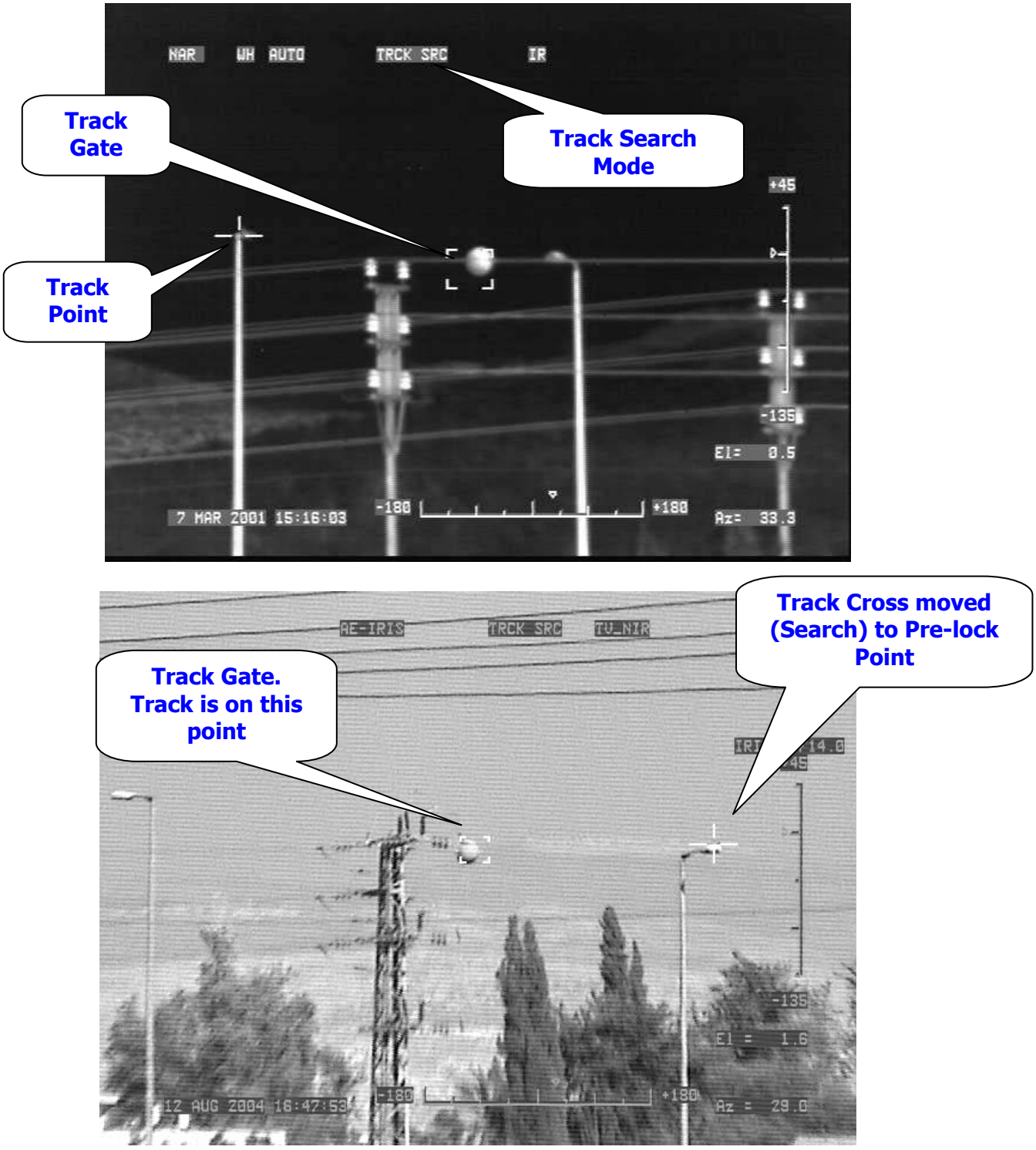

Figure 6-1. Typical Track Function Symbology

Note
The track point is always the center of the track window symbol.

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2.5.3 Track Mode - Selection and Operation

To activate track mode, place the FLIR or DTV reticle on the target and press the track button on the HCG or send the appropriate command via the uplink communication.

a. **Normal Track:** Hit the track button, if image is contrast enough, than tracking is activated and track symbology appears. The gate size is automatically adjusted to the target size.

b. **Obscuration (Target Lost):** If original target gets obscured, than the tracker tries to predict where it may reappear by continuing moving the LOS to that location. If within 6 seconds target does not appear, than the system returns to inertial mode, leaving the LOS at its last pointing direction.

c. **Adjust:** You may improve the track point for better reliability (better contrast) by a fine adjustment of the tracking point (crosshairs) on the target. Press the FT to move the tracker cross hair to the new pointing. The tracker gate displays will blinking and moved in direction as the pressure transducer reported, and the tracker windows will follow with.

d. **Search:** While the system is in track mode, you may select a new target to track on – without breaking lock on the current one.

- ➡ Press the track button for 3 seconds or more (or send the proper command via the serial link) until the legend TRCK SRC starts to blink, than release the button. See figure 6-1.
- ➡ Next using the FT (or rate commands) mover the track window on to the new target.
- ➡ Press again – shortly - on the track button. The LOS will move to the new selected target and will try to relock.

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> **Note:**
> **The window size of the tracker may change during track. The smaller the window is, the "quality" of the tracking on the target is better.**

2.5.4 Exiting Track Mode

Cancel track state by pressing the INT/POS button or transmitting the inertial command to the payload. All other turret commands will not affect track mode.

2.5.5 Prediction Mode

The POP200 tracker has a build in prediction mode. If the object that is tracked get obscured, or its contrast becomes too faint then the tracker tries to predict how the object continues to move (relative to the LOS) and according to that, it's change the track gate symbol line to be a broken gate symbol line.

In parallel it continues to move the LOS hopping that "soon" the target will reappear.

This process takes 6 seconds, if the target is found then the tracker re-locks, otherwise it declares lost of target and lost track symbol will display.

Immediately after that the system will force itself to inertial mode, hence leaving the track mode.

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3 Controlling and Optimizing the Image Quality

All controls refer to the sensor, which was selected to be as a prime. They will NOT have any effect on the other sensor.

3.1 FLIR Channel.

3.1.1 FLIR Focus

MFS

At the end of FLIR initialization, FLIR focus is set automatically to infinity. Press shortly the focus button up or down, to go focus NEAR or FAR. (or by sending the proper command via the uplink) to enable adjust the image to optimal focus. It is recommended to press shortly and very gently, in order to develop sensitivity to the change during focusing.

When you send the FLIR focus command, the Multi function Scale (MFS) will appear for 6 seconds indicating the relative position of the focus.

3.1.2 Focus to Infinity.

Definition: The point at each FOV, where the image focuses on an average is probably the best.

Press (or command) the FOCUS button IN. This will force the IR focus to move to the infinity point and the DTV focus to tries again and refocus automatically.

3.1.3 FLIR Focus Memory.

FLIR focus position is memorized for each FOV. So when the user switches from one FOV to the other, the focus for the newly selected FOV, goes automatically to its previous position in that FOV.

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3.1.4 IR Fields Of Views (FOV)

The FLIR image in POP200 system has four fields of view:

(1) Wide FOV (H x V)	22°	x	16°
(2) Medium FOV (H x V)	6.90°	x	5.20°
(3) Narrow FOV (H x V)	1.72°	x	1.29°
(4) Super Narrow (H x V)	0.8°	x	0.65°

At power up the system goes to the WFOV. Changing from one FOV to the other is sequentially. There is a forced delay after each switch, of 1.5 seconds before the next switch is allowed.

When the FLIR changes FOV, the focus goes to the previously set focus on that FOV.

3.1.5 FLIR Polarity

Purpose: To select or modify the FLIR image polarity:

WH: The more white the image is, the hotter it is.

BH: The more black the image is, the hotter it is.

Press the HCG sensor button IN (or send the proper command from the host). It is recommended to practice in different field scene images (especially at night) in order to receive the optimal feeling on the proper POLARITY, to use.

White = Hot

Black = Hot

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3.1.6 FLIR Gain/Level Control.

MFS

Purpose: To allow the user to fine tune the FLIR image and depict certain objects in the scene.

AUTO mode is the default mode after power up. In this mode the system determines by itself the values of GAIN and LEVEL of the FLIR camera to optimal values. The operator can improve the image, by entering into a MANUAL mode.

Change to MANUAL by pressing shortly on the AGC button IN. Verify the legend **MAN** appears on the FLIR status area.

Press shortly on the GN or LV pushbutton towards up or down, as required on the HCG (or send the proper commands on the uplink to the payload).

When the operator attempt to change the gain or level, manually, the Multi function Scale (MFS) will appear for 10 seconds indicating the relative position of the associated parameter.

> **⌦ Note**
>
> Using GAIN LEVEL mode requires some experience by the operator, and it is recommended that only a skilled operator will use it.

Transition between automatic and manual modes:

a. When changing FLIR tables – always return to automatic G/L.

b. When changing to manual in the same FLIR FOV, the system returns automatically to previous values (history) of GAIN LEVEL values.

c. When in manual mode and changing fields – the new FOV will be at AUTO GAIN.

☛ **Tip**: After you go to manual mode, try first the GAIN UP (or down) for better results. Only then change the level.

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3.1.7 FLIR Semi Automatic AGC

Purpose: To allow the user to fine tune the FLIR image in environment where the background changes rapidly.

FLIR Semi Automatic AGC: This mode is applicable for slice SW version #16 or higher.

In this mode the GAIN is controlled manually, while the LEVEL is set automatically by the system. Enter this mode, using a short press on the GAIN UP. The legend **AE_GAIN** appears on the FLIR status field.

Exit this mode to full auto by a short press on the AGC button IN. Verify the legend **AUTO** appears on the FLIR status area.

3.1.8 Freeze the FLIR Image.

FZ

Purpose: To enable the user to freeze a dynamic scene, in order to investigate in more details a certain event or dynamic target.

Operation: Press shortly on the HCG, the sensor button FZ position (right). This action will freeze the FLIR image on the display. **FREEZE** legend appears on the FLIR status field.

To release the freeze, press shortly again on the FZ button.

Note that in FREEZE mode the Tracker, Laser pointer and the LRF functions, are disabled.

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3.1.9 Non-uniformity Tables Replacement

TBL

Purpose: To select (or change) FLIR uniformity tables.

For details on NUC tables, see paragraph 8 in this document.

Each table is optimized to a different range of temperature scenes. You may scroll among the three tables by pressing shortly the MENU button to the TBL position (or sending to the payload uplink the proper command)

(You may also select each table via the system menu option, see Figure 10-1).

When you select the TBL option, a question will be displayed, asking you to confirm your request. Ignoring the question will leave the current selected table, and the question will disappear from the image. A second press on the TBL button will scroll to the next table.

CHANGE TBL ?

Default selection at power up is table #1 referred to as WARM. You may view the current table, by scrolling between the symbology layers, until it will appear on the upper right side of the FLIR image.

Each press will transfer to the next table as follow:

- At power-up and when the FLIR completes initialization: Table #1, WARM.
- **First** click: Table #2 **COOL**
- **Second** click: Table #3 **COLD**
- Next click: Table #1 **WARM**.

⌦ Note

Under normal FLIR operation, there is no need to change uniformity tables

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Table exchange may be considered only in a case of extreme changing of the background temperature scene, such as transition between day and night.

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3.1.10 Automatic (One Point) – Non Uniformity Correction.

STW----→

Purpose: To enable the user to perform quick "One-Point Non-Uniformity" correction during operation, in a simple way without loosing time.

✖ Caution !

Before performing this 1-Point NUC, be sure you do understand how this procedure affect the image, and what you expect to get afterwards.

In any case using this procedure requires some training and expertise from the user.

First step is to make sure that there is a "target" in the scene that you will be able to point the payload LOS to it. This target will be the reference plate to perform the 1-Point NUC and it should comply with this:

a. **The target should cover the whole field in the NFOV.**

b. **The temperature target is relatively uniform and close to within the scene temperature to within approximately ±10° (preferred less).**

Possible targets: The sea surface, clear sky, desert ground, a plate that is installed for this purpose in a "not used section" of the view.

Here is the process:

a. **Assuming the LOS was previously calibrated towards the "External Plate".**

1. Press – and DO NOT release - the HCG turret mode button, in to STOW position and follow the text on the screen.
2. A NUC legend appears, follows by AT NUC legend. At this moment **release** the button.

AT NUC

3. The 1-POINT NUC process starts and proceeds all the way automatically. Note that when the LOS reaches its target position, additional legend appears:

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AT NUC	A NUC POS

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4.At the end the system LOS returns to its initial position with the initial FOV and focus.

b. Assuming the LOS was NOT calibrated towards the "External Plate".

1.Press – and DO NOT release - the HCG turret mode button, in to STOW position and follow the text on the screen.

2.A NUC legend appears, follows by AT NUC legend, followed by NUC POS CFG. At this moment **release** the button.

AT NUC	NUC POS CFG

3.Go the WFOV or MFOV so will be able to find easily the target.

4.Now, use the FT to slew the LOS to the selected "target" scene. Set the target at the center FOV

5.Once the LOS is on the "target scene", go back NARROW FOV. Now the system is ready to continue the process

6.Press shortly on the STOW button IN – to complete the process.

7.The "external 1 - POINT NUC" process starts and proceeds all the way automatically. Note the legend:

AT NUC	AT NUC POS

8.Also the LOS that you have selected will be stored for future corrections, as a default direction.

9.At the end the system LOS returns to its initial position with the initial FOV and focus.

Notes:

a. The default (factory set) direction for this process is elevation 0° and azimuth 180° (back of the payload).

b. The new selected LOS data above, (item 5) is stored in the nonvolatile memory for any next operation (as a new calibration of CAGE LOS).

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3.2 DTV Channel – for POP Models 200

This section refers to the standard POP200 DTV Channel, with base optical zoom ratio of 1:16

3.2.1 DTV Focus.

DTV Manual Focus

The TV focus is set automatically at the end of each zooming. The user may manually control the focus to FAR or NEAR. Click on the FOCUS button to FAR or NEAR. From this point and on, the TV focus remains in manual.

Transition back to auto focus is made when the user zooms again the DTV, or press shortly the FOCUS button IN to go to "focus to infinity".

⌦ Note

DTV focus is set automatic at the end of each zoom. Once the DTV focus is set, it will not tries to refocus if the scene has changed - unless the user zooms, or a "focus to infinity" is commanded.

Figure 3.2-1 typical DTV 200 image

HAND (POP200): Indicates that TV zoom or focus were selected

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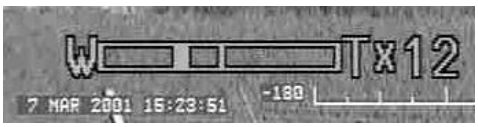
3.2.2 DTV Zoom.



TV ZOOM Indicator

The DTV image, has a continues optical zoom of ratio 1:16 and additional electronic magnification of X32. (in this mode an **ELZM** legend appears to indicate a position of electronic zoom).

When the operator attempts to change the DTV zoom, manually, the Multi function Scale (MFS) will appear for 10 seconds indicating the relative position of the zoom accompanied with a number of the actual zoom relative to the wide, being as 1.

3.2.3 DTV - Shutter Speed Control.

TV Shutter Speed indicator

The TV shutter speed can be adjusted with the GAIN up/down button. When you select this option the actual value of the exposure speed will appear on the image.

The values are: 1/60 of a second, which is the default, and consecutives values till 1/10,000 of a second. Note that any selected value will be memorize by the system and will be used for the next system power up.

If the default value is not the selected one, than each time the user zoom the DTV, the actual value will appear on the DTV image.

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3.3 DTV Channel – Model 200-6

This section refers to the enhanced POP200 DTV Channel, with base optical zoom ratio of 1:22.5. This sensor is an optional for the POP200 and standard for the POP300 (Also known as 200A).

At power up note the legend **AE – FULL**. Image is in color mode.

3.3.1 What is New?

This DTV/CCD sensor has the following improvement compare with the standard DTV/CCD

	Feature	Standard DTV	Enhanced DTV
1	Sensor	1 / 4 "	1 / 6 "
2	Zoom ratio (Opt, Elec)	1:16, 16:32	1:22.5, 22.5:45
3	Focus Auto, Man	Yes	Yes
4	Near IR	No	Yes
5	Full Auto	No	Yes
6	Shutter Pri	Yes	Yes
7	IRIS Pri	No	Yes
8	Full Manual	No	Yes
9	Image Freeze	No	Yes

3.3.2 Near IR

PLR

Short press on the HCG, sensor button – polarity, will toggle mode to NIR. The image will become black-white. The legend **TV_NIR** will indicate this mode. Another press will toggle back to color mode.

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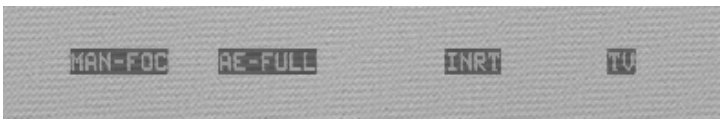
3.3.3 DTV Focus.



The TV focus is set automatically at the end of each zooming. The user may manually control the focus to FAR or NEAR. Click on the FOCUS button to FAR or NEAR. From this point and on, the TV focus remains in manual.

Transition back to auto focus is made when the user zooms again the DTV, or press shortly the FOCUS button IN to go to "focus to infinity".

When in manual focus, the legend **MAN-FOC** appears on the upper right corner of the image.

3.3.4 DTV Zoom.

TV ZOOM Indicator

The DTV image, has a continues optical zoom of ratio 1:22.5 and additional electronic magnification of X45. (In this mode an **ELZM** legend appears to indicate a position of electronic zoom).

Press and hold the HCG FOV button to control the zoom. Each press will causes the zoom status bar to appear. It will stay for 6 seconds after you release the FOV button.

The DTV zoom bar acts like an MSF bar. The actual zoom marker position runs from left (OPTICAL X1) to the center (OPTICAL X22) and to the right (ELECTRICAL X45).

3.3.5 Freeze the DTV Image.

FZ

Purpose: To enable the user to freeze a dynamic scene, in order to investigate in more details a certain event or dynamic target.

Operation: Press shortly on the sensor button of the HCG, to FZ position (right). This action will freeze the DTV image on the display.

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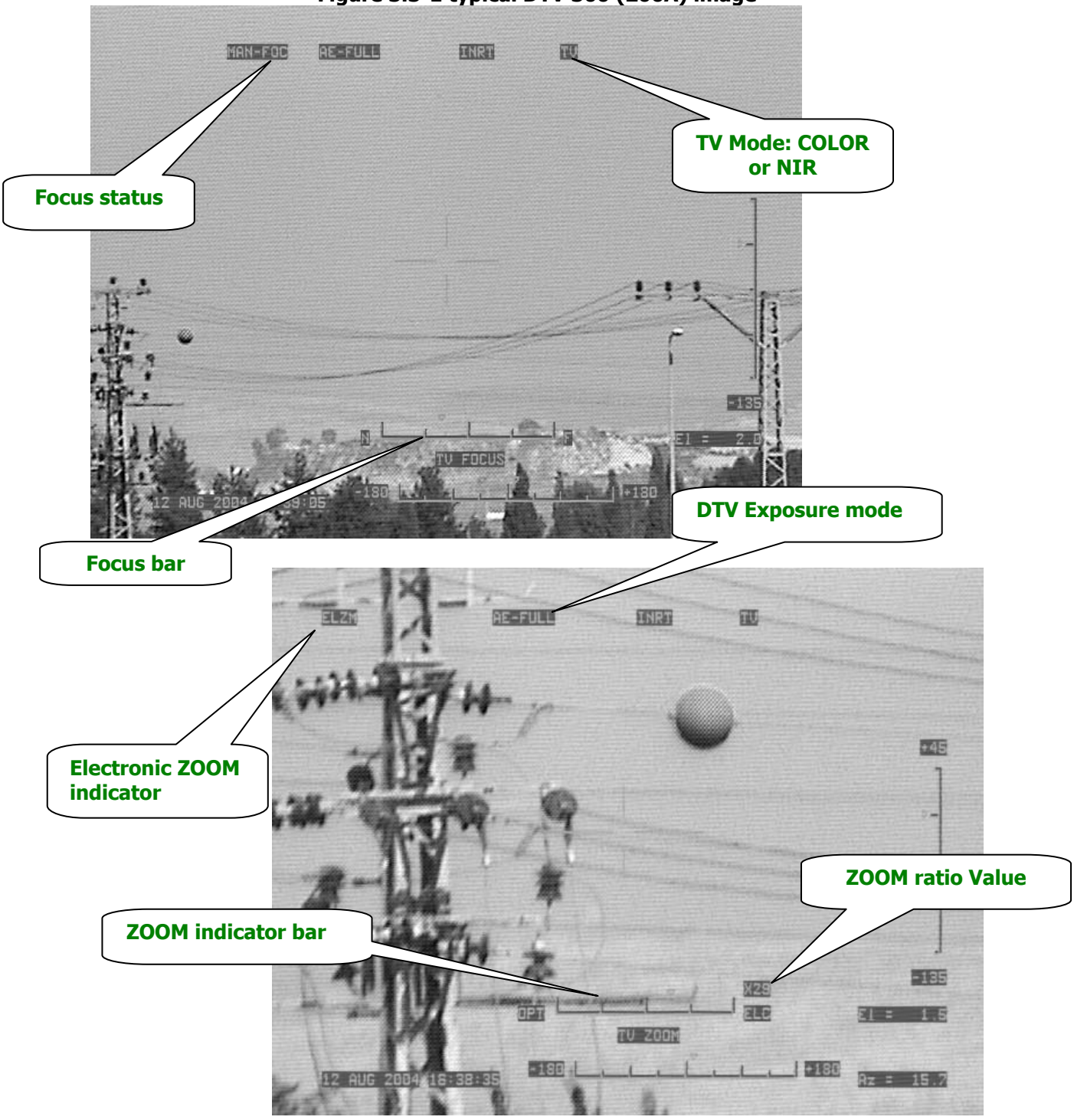
FREEZE legend appears on the FLIR status field. To release the freeze, press shortly again on the FZ button.

Note that in FREEZE mode the Tracker, Laser pointer and the LRF functions, are disabled.

Figure 3.3-1 typical DTV 300 (200A) image



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3.3.6 DTV Modes of Operation

The DTV default at power up is full auto. The legend **AE – FULL** indicates this. In this mode all parameters of the camera settings are controlled by the camera internal logic: Shutter speed, IRIS, over/under exposure, gain and White balance.

You may at any time scroll the image layers and bring up the DTV status field, on the upper right portion of the image; this field presents the following current DTV data:

- Shutter speed in tenth of a seconds: 1/15 (1/12 PAL) to 1/10,000
- IRIS in F ratio number: F1.6 to F28.
- Zoom in relative ratio: X1 to X45.
- FOV in milliradianns: 380 to 8.5

Figure 3.3-2 Typical DTV status field display (300, 200A) image

3.3.6.1 Over/Under Exposure Compensation

Description: This function shifts slightly (manually) the automatic operating point of the DTV (gain, shutter, iris) to brighten or darken the image. You may increase the exposure by 7 steps, (image more brighter) or decrease it by 7 steps, (image more darker)

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Purpose: To "fine tune" the image. To control image quality while the camera is still in full auto mode.

Operation: This mode is operational only when the DTV is in AE – FULL. Short press (Less than 1 second) on the GAIN UP, will enter to this mode. To increase exposure, click the GAIN up. To decrease exposure, click the GAIN down. Exit this mode by short press on the GAIN – to IN.

Status display: In the status field, **EXP – COMP**. In the DTV status field, see the line COPM +/- #, indicates the value of over/under compensation: 7 steps up, and 7 steps down.

> ⇨ **Tip**
>
> **Use the image brightness to decide which is the best exposure to use. Under standard conditions, the camera selects the best exposure.**

3.3.6.2 Shutter Speed Priority.

Description: Select and control the shutter speed of the camera, refer to also as shutter priority mode. You may select values from 1/15 second (image brighter) up to 1/10,100 second (image darker).

Purpose: To have the shutter speed fixed and controlled by the user.

Operation: When enter to this mode, the shutter speed is fix and the user selects its value. Long press (3 seconds) on the GAIN UP, will enter to this mode. You may enter this mode while the DTV is in AE full or in IRIS priority modes.

To increase speed, click the GAIN up. To decrease speed, click the GAIN down. Exit this mode by short press on the GAIN – to IN.

Status display: In the status field (upper left portion of the display), **AE - SHTR**. In the DTV status field, see the line SHTR #, indicates the value of the speed.

The first entry value of the shutter speed is the current speed in auto.

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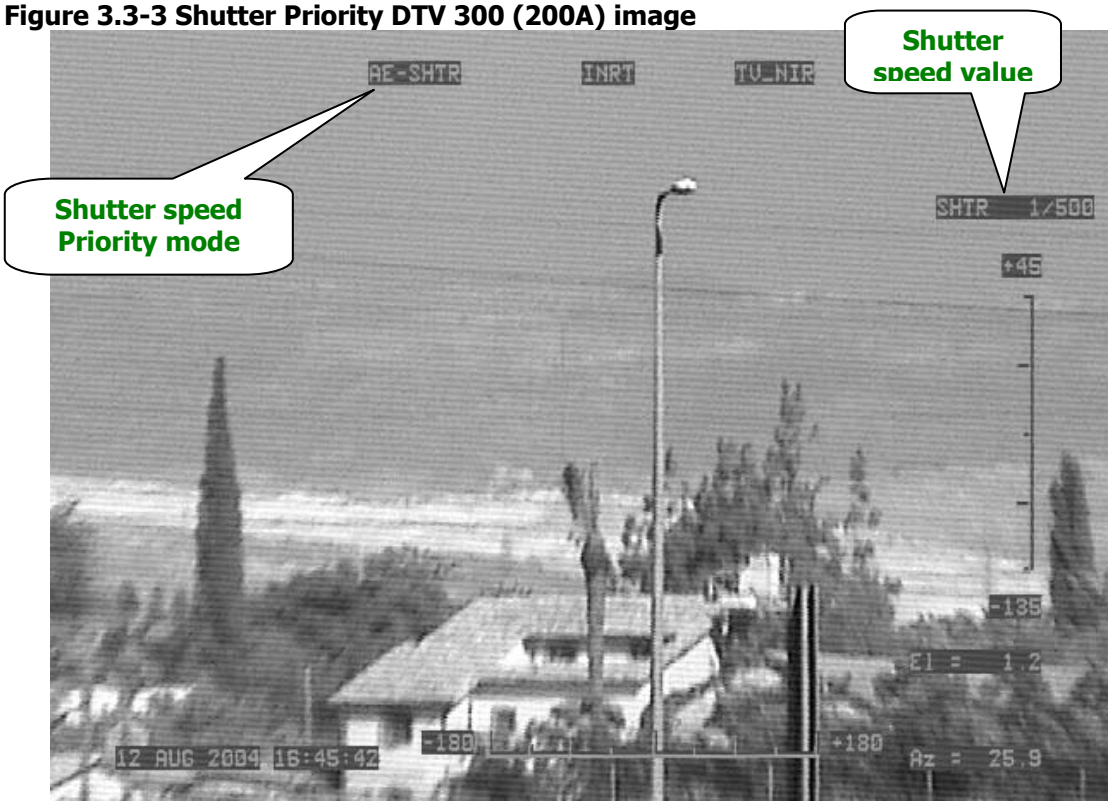
Figure 3.3-3 Shutter Priority DTV 300 (200A) image



⇨ Tip

Increase speed when the image looks too bright.

3.3.6.3 IRIS Priority.

Description: Select and control the IRIS of the camera, refer to also as IRIS priority mode. You may select values from F1.6 (image brighter) up to F28 (image darker).

Purpose: To have the IRIS fixed and controlled by the user.

Operation: When enter to this mode, the IRIS is fix and the user selects its value. Long press (3 seconds) on the LEVEL UP, will enter to this mode. You may enter this mode while the DTV is in AE full or in Shutter speed priority modes.

To increase (close) IRIS, click the LEVEL up. To decrease (close), click the LEVEL down. Exit this mode by short press on the GAIN – to IN.

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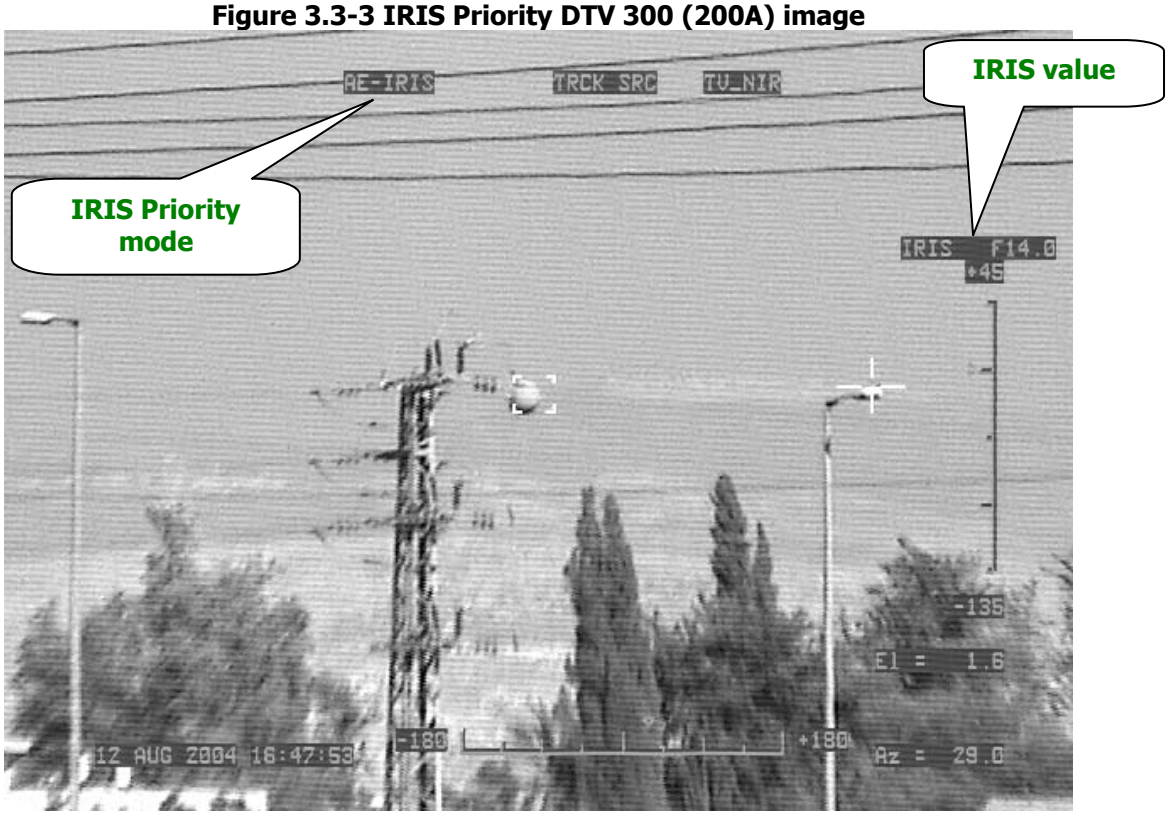
Status display: In the status field (upper left portion of the display), **AE - IRIS**. In the DTV status field, see the line IRIS F#, indicates the value of the IRIS.

The first entry value of the IRIS is the current IRIS in auto.

Figure 3.3-3 IRIS Priority DTV 300 (200A) image



⇨ Tip

Increase IRIS (more of the F) when the image looks too bright.

3.3.6.4 Full Manual mode

Use of this function by expert user only.

Purpose: To enable the user to have a full control on the shutter speed and the IRIS.

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Description: In this mode the user can set the shutter speed from 1/30 to 1/10,000 and IRIS from F1.6 to F28 (next click will close the IRIS).

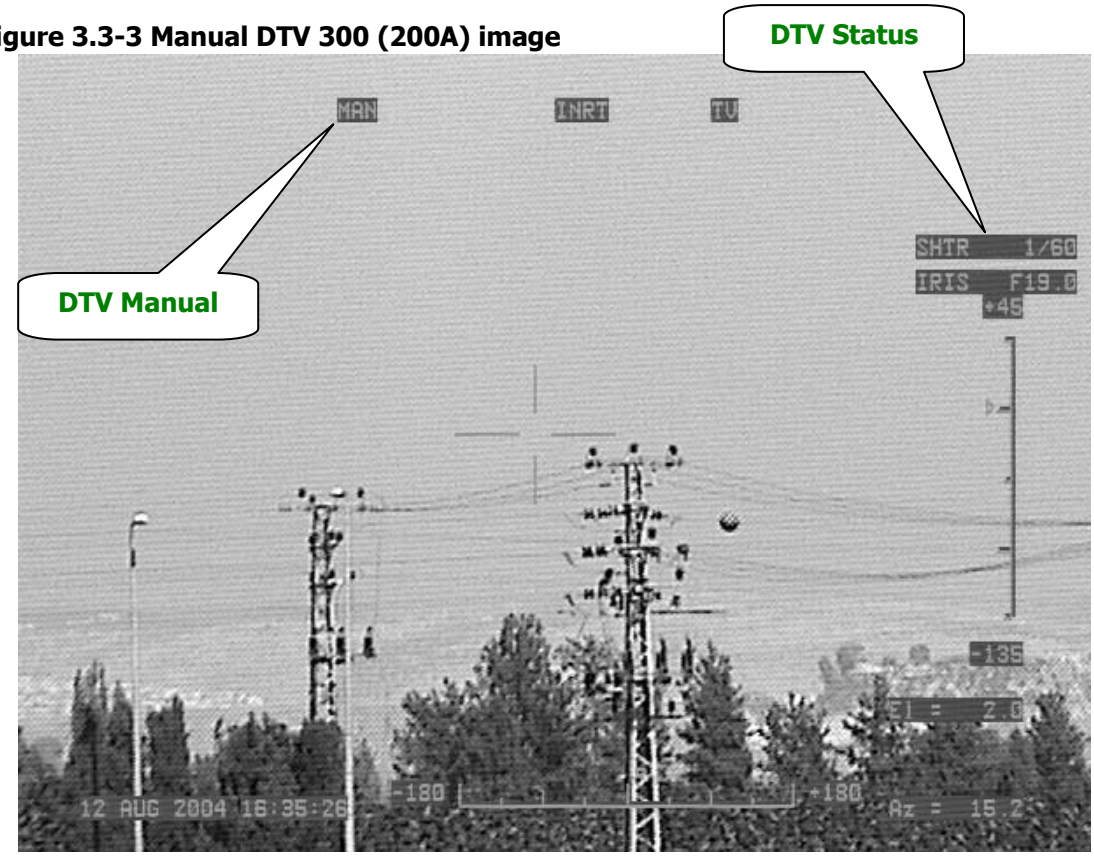
Operation: Short press on the AGC button IN will set the system to full manual mode. Next press on AGC will return the DTV to auto.

Status display: In the status field (upper left portion of the display), **MAN .** In the DTV status field, see the line IRIS F#, indicates the value of the IRIS.

The DTV status sub field – comes up automatically, and presents two lines of actual data:

- Shutter speed in tenth of a seconds: 1/15 (1/12 PAL) to 1/10,000
- IRIS in F ratio number: F1.6 to F28.

Figure 3.3-3 Manual DTV 300 (200A) image



✖ Caution

You may set accidentally the IRIS and the SPEED to values, which will cause the DTV image to disappear (Bright or dark image). If so, press shortly the AGC button, to revert to FULL AUTO

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4 Manipulate the Image symbols.

4.1 Symbology Layers Modification

SYM

Purpose: To control the amount of symbology and information which is overlaid on the image at a certain time.

You may clutter or declutter the symbologyl layers that are on the screen. When there is a need to remove symbology or a certain segment in the symbology, that covers important details of the area. It is possible also to remove all the symbols from the screen. The symbology appears as 5 layers that can be removed from the screen, one by one, according to the following order.

a. Direct Scroll

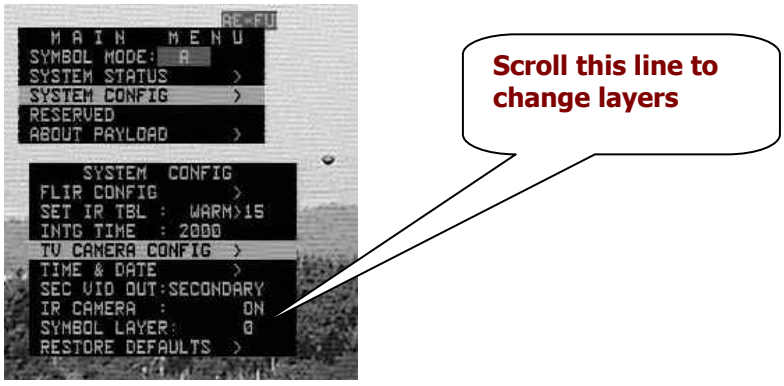
Each click on the sensor pushbutton down (SYM) will remove one layer at a time (or by sending the command on the uplink from the host).

The layers removal order list is as follow:

1. At system power-up: Reticle, angle markers, system status and TOD.
2. **First** click leaves: Attitude bars, system status and TOD.
3. **Second** click: Without any symbol on the image.
4. **Third** click: Reticle only.
5. **Forth** click leaves: Reticle, attitude bars, system status TOD and FLIR status.
6. **Next** click, returning to (1).

b. Menu Scroll

You may also scroll the layers, via the MENU layer status line as follows:



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4.2 Symbology Hue Modification

HUE

Purpose: To control hue of the symbology, so it will not fade away in a certain background.

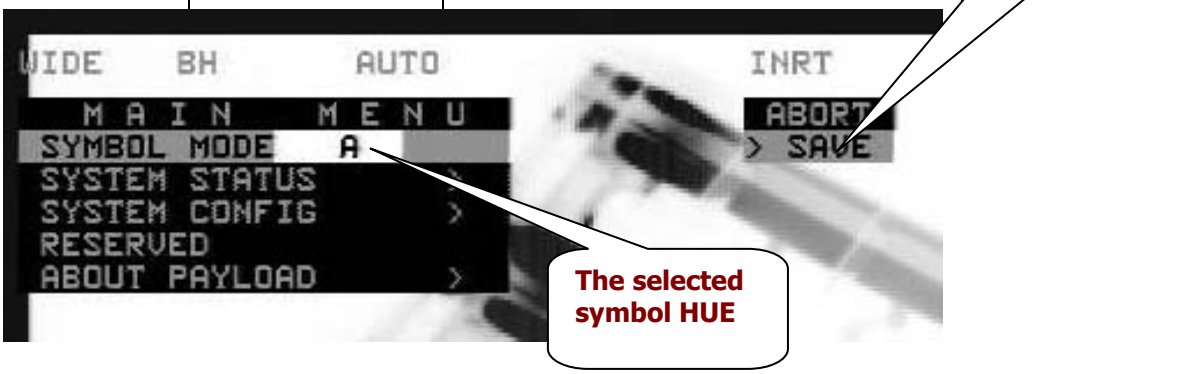
Hue modification is done as follows:

a. Using the **MENU button**, click up to HUE. The hue will change sequentially. Selecting hue this way will leave the payload hue at power up at its default, or:

b. Through the POP200 **MENU option** by scrolling the first line item. In this case the user can see the hue on a sample "A" letter, before actual execution. Using this option requires user approval "SAVE". Next power up will be using the last selected HUE.

Six different hues are available.

Order	Test color	Text background
1	White	Grey
2	White	None
3	Black	None
4	Grey	White
5	Grey	None
6	Black	White



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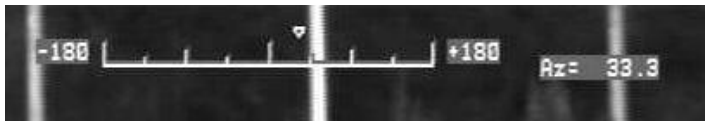
4.3 Modify Azimuth Reading.

MAN----→



Purpose: To enable the AZ reading to refer to a known azimuth, typically the north.

This mode is available only for systems, which does NOT carry the LRF sensor.

How to set this reading?

1. Point the LOS toward the target, which its AZIMUTH value is known.
2. Press IN, a long press on the HCG AUT/MAN button about 3 seconds until a legend SET NORTH will appear on the display.
3. Notice that the **Az** = XY.Z legend on the right bottom, becomes

   AzN = XY.Z
4. Now use the GAIN position UP or DOWN to increase or decrease the AZ reading (XY.Z in this example) on the bottom right of the display, so it will read the absolute azimuth of the known target the LOS points at.

How to leave setup mode ?

To leave the setup mode – press again the G/L in, while there two ways to do so:

a. Short press: Will leave the new AzN reading for this session of system operation. After power recycling the azimuth reading will refer to the mechanical installation as normal and the recorded AzN data from the past will be lost.

b. Long press: Will leave the new AzN reading for this session of system operation. After power recycling the azimuth reading will refer to the mechanical installation as normal. However the recorded AzN data will be stored in the turret nonvolatile memory for future use.

Now the azimuth reading will refer to this selected point.

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✖ Caution:

Do not move the payload from its current position, after performing AzN, other wise this reading will become meaningless.

How to deselect AzN mode ?

a. Power recycle will bring the system to normal azimuth display. Or

b. While in AzN mode, long Press as describe above, will bring the SET AZ NORTH on the upper screen. While this legend is on pres again shortly IN on the HCG AUT/MAN button. This will cancel the AzN mode.

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5 Laser Range Finder Operation

5.1 General

The Laser Range Finder (LRF) is an optional sensor in the system. When it is operating (fires) is an eye safe device. Nevertheless it is recommended NOT to point the LOS (laser beam) towards a human or an animal.

5.2 Operation

5.2.1 Ranging

LRF Sensor Indication

Figure 5-1 HCG, LSR button

Verify that the system is in LRF mode. The legend **IR (or TV) – LR**F should appear in sensor status field.

Any press will generate a ranging pulse (and measurement). If you press and hold the button, the LRF will range continuously, each second, and update the display accordingly.

✖ Caution

Do not hold and press the LRF Fire button to long if NOT necessary. Hold it just for the time you need to measure range. It may cause the LRF to over heat and its performance in the short term may be degraded.

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5.2.2 When Ranging is Allowed.

Ranging is possible only in the following modes:

Inertial, Position or tracking.

Ranging will NOT be activated if the payload is in one of the following modes:

- Standby or slice initialization (SINI) or turret initialization (TINI).
- CAGE, AUTOSCAN or image FREEZE.
- Nun uniformity correction or system backup

Also ranging will NOT be allowed when you point into the "ranging forbidden zone" – if a zone was selected.

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5.2.3 Range Display

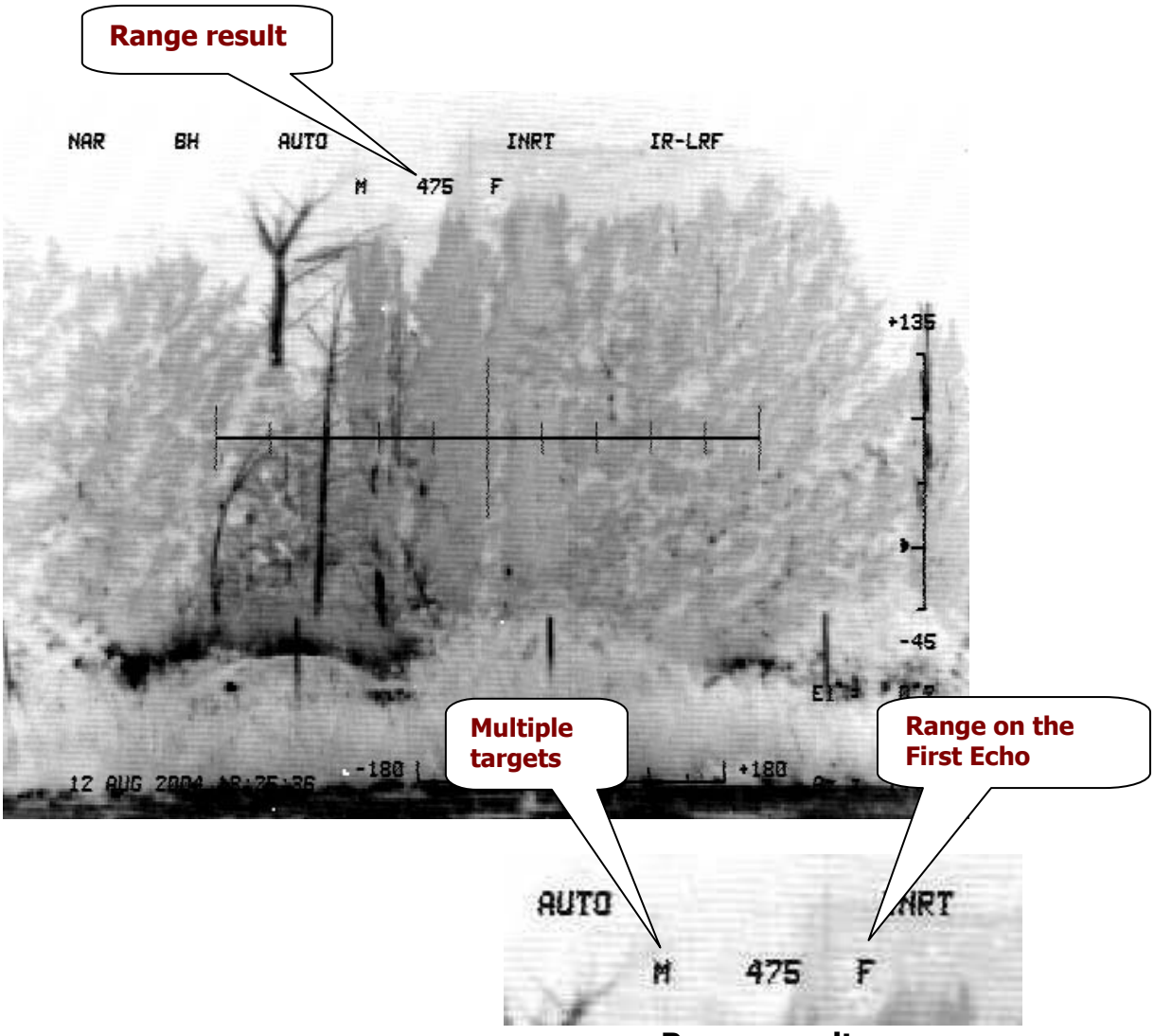
Immediately after fire you may get the following result:

M: If the LRF encounter several echos.

Number (meters) indicating the range.

F / L: Indicates that the range relates to the First echo or Last echo.

Range data is displayed for limited time: 5, or 10, or 20 seconds (depending on a maintenance setup selection)



Range results

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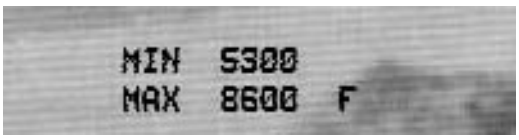
5.2.4 Setting LRF parameters

MAN----→



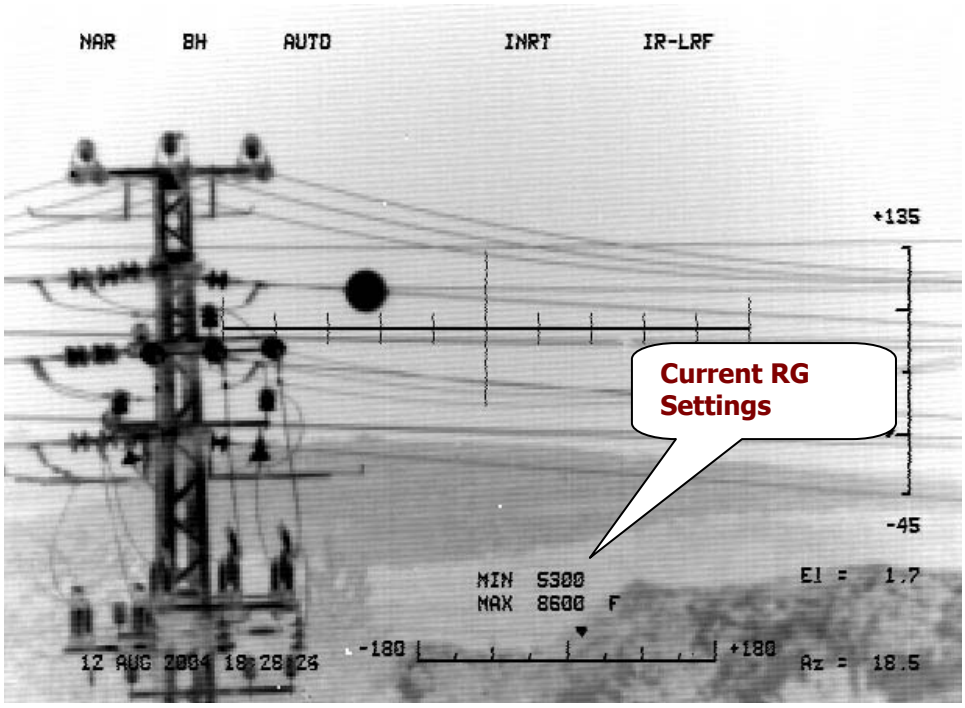
LRF RG Setting

Purpose

This section explains how to set LRF parameters:

- Minimum range
- Maximum range
- Select the First (F) or Last (L) echo to use as a target.

On the HCG press and hold the AGC button IN, for 3 seconds or more. The status of the current Min Max range gates and F/L echo will appear on the bottom of the image.



1. By clicking up or down the GAIN, you change the minimum range value.
2. By clicking up or down the LEVEL, you change the maximum range value. (Short press will increase by 100 meters and long by 1000 meters).
3. By clicking in the GAIN, you toggle the selection of F / L value.
4. To store these values, exit this mode by LRF firing, press LSR.
5. Or if you wish NOT to store, than press inside the AGC button.

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These values are stored in the system non-volatile memory, for future use, also after power recycle.

5.3 Ranging Fail

There are several cases when range results are not available:

a. In case that the LRF was not able to get echo. In this case the data that will be displayed in null:

b. Firing into a NO FIRE ZONE. "**NO FIRE**" flashes.

c. If the LRF was not able to generate a pulse, or the operator fires into a no fire zone, than the legend **NO FIRE** will appear for several seconds.

5.4 No Fire Zones Window

5.4.1 Setting and Update the "No Fire Zones" Window.

The following describes step by step, how to define a "no fire zone" (window).

Application: No fire zone is useful when you know for sure that if you fire the LRF to this direction, its beam may hit a known object and reflects back towards a person walking by.

When you set this window, its value remains in the system non-volatile memory. When you turn off and back to on the payload, it will continue using the last set window. (Same logic as for the logic for setting the auto scan window).

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To define a window, enter the LRF range gate setup by long press on the AGC button IN. If the data of MIN/MAX appear you may proceed with the window setting.

a. Press the AS button for 3 seconds until a legend FZ CFG (or AS CFG) appears on the turret field and the following appears on the bottom of the screen.

FIRE ZONE CFG
P1

b. Now, slew the LOS to the **upper left** corner of your desired window.

c. When the LOS on the proper point, press shortly the AS button (down).

d. The window status legend will be updated as follows:

FIRE ZONE CFG
P1 AZ = 157.9 EL = - 0.7
P2

e. Now, slew the LOS to the **lower right** corner of your desired window.

f. When the LOS on the proper point, press shortly the AS button (down).

g. The window status legend will be updated as follows:

FIRE ZONE CFG
P1 AZ = 157.9 EL = - 0.7
P2 AZ = 167.3 EL = 1.4

h. Press shortly on the AS to complete the process. The dialog box disappears.

i. Press shortly on the INERTIAL to enable slew.

j. Now the process has been completed.

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You may abort this process at any time, without its completion, by simply pressing shortly the MENU button, in.

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5.4.2 Canceling the "No Fire Zone".

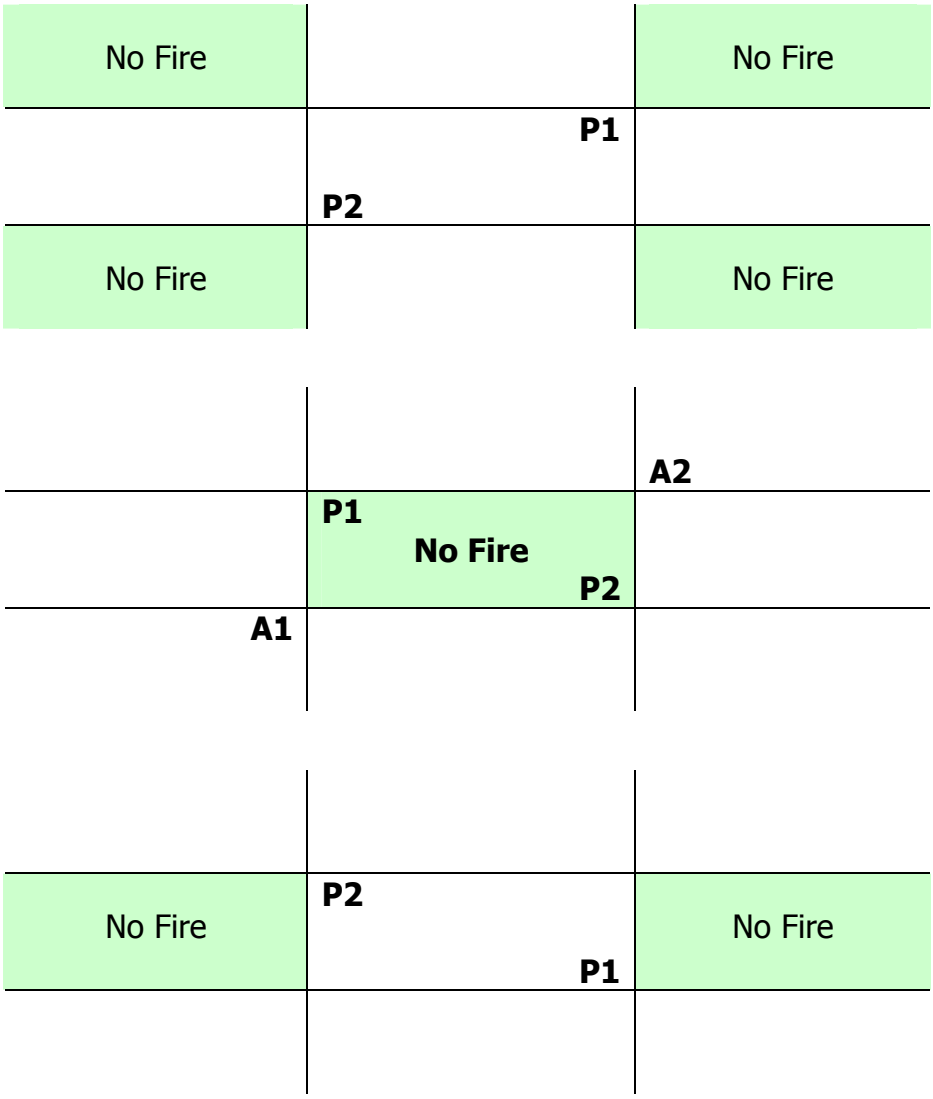
Enter to "set RG parameters mode" by long press on the AGC button – IN.

Start to define a new window, where its two corners are identical. (Simply do not slew the LOS after you define the first point). In other words, when you see P1, hit three times shortly on the **AS** button, and once **INRT**

5.4.3 Definition of a reversed "No Fire Zone".

You may define a reverse "no fire zone" window. A reverse window is a window where firing the LRF is permitted only in this window. Do so by defining first, P1 to be the upper right point and secondly, P2 as the lower left point.

Various "NO FIRE ZONE" definitions as a function of the order of definition P1 (or A1) and P2 (or A2):



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6 Laser Pointer Sensor - Safety Instructions and Operation.

6.1 General

LPS Sensor Indication

The Laser Pointer Sensor (LPS) is an optional sensor in the system. When it is operating (fires) is a non-eye safe device. As such it may cause damage to the human or animal eye when operated directly to the eye.

Payload which contains LPS will display the IR-PTR (or TV-PTR) indication on the sensor status field.

LPS generates a red optical spot on the target. The spot is in the 830 nanometer wave band and as such is not visible to the human naked eye. In order to identify the spot on the target, one must use night vision device, which is adapted to this wave band.

Whenever you operate the payload, make sure that the legend

PTR-EN

Does not appear on the display. Its appearance indicates that the LPS is triggered and ready to fire.

As a general thumb rule, never try to operate the LPS in a non-controlled manner, or for testing purposes. Never try to operate it for "just to see how the spot looks like".

✖ Laser Pointer Non Safety zone

The LPS non-safe area (for a standard POP200 laser pointer) is defined as a cone of ±5° around the payload center line of sight, and the range of up to 300 meters (1000 feet). Any human or animal being in this area, might be hurt.

POP200 May be equipped with other type of LPS, which uses less energy to fire, for civil application such as police helicopter. In this case the safety range would be 20 meters (70 feet).

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The following are the main characteristics of the LPS, for user reference only.

	Parameter	Value
1	Output Power	Standard LPS: 50 - 60Mw Low power LPS: 20 - 30 Mw
2	Beam Divergence	Standard: 0.5 Mrad nominal for 50% energy Low power LPS: 3.0 Mrad.
3	Wavelength	830 nm. Nominal
4	Beam diameter	9±1mm

Laser Pointer Identification

The laser pointer sensor is located inside the lower section of the slice payload. A 15 milliliters diameter hole, covered with window, enables the fire of the laser beam onto the target. See figure 1 for detail location.

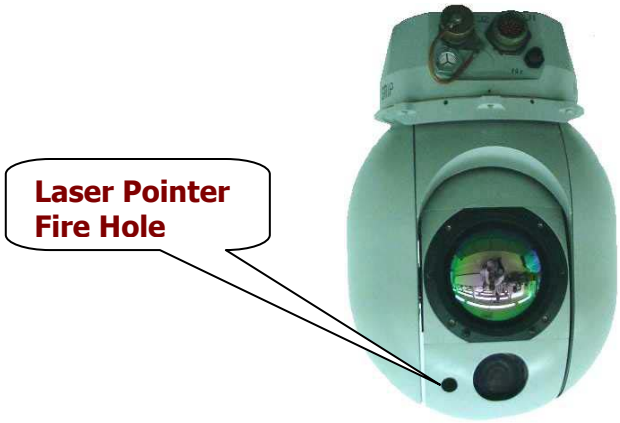

Figure 6-1 – Laser pointer fire hole

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6.2 Detail Safety Instructions.

6.2.1 Important Guidlines

- **The LPS emits an energy, which cannot be seen by the human eye. This energy when hit the human or an animal eye, may cause damage or even blindness.**
- If the payload is powered, always avoid from direct staring to the payload window.
- The classification of the POP200 LPS is **CLASS IIIB.**
- Wave band is 830 nanometer.
- Angle of beam divergence is 0.5 milliradiands (or 0.03 degrees)
- Before you mark a target, verify that no human or animal are in the LPS field of view.
- Use of the POP200 LPS is prohibited, if the user has not completed an instruction and safety course on the use of the LPS.
- Never fire the LPS on reflective surfaces, mirrors nor lights.
- Minimum safety range is 300 meters (1000 feet), on a direct view. Any use of an optical magnification such as binocular, will increase this range by the magnification ratio of the device.
- Minimum Safety sector on a direct view is ±5°.
- If you remove and install a POP200 optronic slice with LPS, make sure to update the non-fire area of the LPS in the payload.

6.2.2 LPS Operation Actions Highlight.

- Trigger the LPS, by pressing the LSR button on the HCG for 3 seconds or more. (See figure 2)
- When the LPS is triggered, every press on the HCG LSR button will cause emission of energy. As long as the button is held, the LPS fires continuously.
- When the fire button is released, the LPS is triggered for 2 minutes.
- Continuous fire will be halted after 2 minutes count. (This figure can be change via a maintenance procedure).
- Cancellation of the triggered state of the LPS is by pressing the MENU button on the HCG.

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6.2.3 Medical Evacuation

- The sense of a laser hit, on a human eye, is characterizes by a feeling of burn or scorch, seeing colors, which are not real, headache or a dead zones in the eye field of view.
- In any event of a laser hit on a human eye, it is required to immediately evacuate the person to a hospital, in state of sitting or standing.
- It is preferred that the injured person will close his eyes.
- In any case, DO NOT try to open by force the eye of the injured person.

6.3 Laser Pointer Operating Instructions

The following section gives a detail instruction on the following operational features of the LPS:

a. Definition of no fire and safety zones.
b. Triggering and firing the LPS.
c. Update the No fire zone (window).
d. Update the safety zone (which is a maintenance procedure).

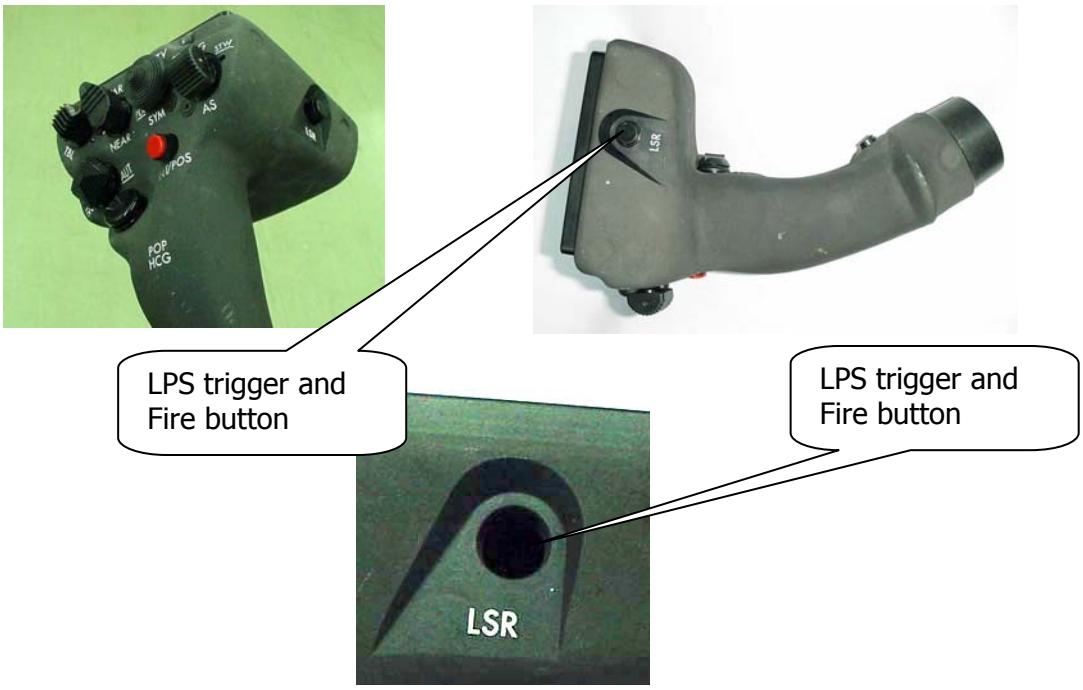

Figure 6-2 HCG, LSR button

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6.3.1 No Fire and Safety Zones definitions

POP200 has the capability to abort any LPS operation when the Line of Sight (LOS), points onto one of the two specific sectors:

a. Safety zone.
b. No fire zone.

6.3.2 LPS Safety Zone

Safety zone is defined as having any pitch angle below a preset given value. It means that if the user pitch down the LOS below this angle the LPS will never fire.

The value of this pitch is preset and cannot be altered by the user. However it can be set to any given value as maintenance procedure.

The safety zone is preset for the following POP200 typical applications:

Ground stationary or mobile – low mast:	-6°
Ground stationary or mobile – High mast:	-40°
Maritime	-6°
UAVs	No Safety zone set
Helicopter	No Safety zone set

6.3.3 No Fire Zone

The user can set and update a "personal window" in which, when the LOS points to this window, the LPS will never fire. This window is defined as a **"No Fire Zone"**

You can set two types of windows:

a. If the LOS points to this window – LPS will not fire.
b. If the LOS points to this window – LPS will fire only within its boarders.

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6.3.4 Triggering the LPS

⌦ Notes:

It is possible to trigger or fire the LPS, only in one of the following modes of operation:

a. INERTIAL

b. HEADING HOLD (Position)

c. TRACK.

In all other modes of operation, LPS firing will be aborted.

Normally the LPS is not triggered. Any erroneous press on the button will not trigger the LPS nor will generate a shot.

Triggering the LPS is by pressing the LSR button for 3 seconds or more. A legend, indicating that the LPS is triggered will appear:

PTR ENABLE

If the user chooses not to fire, the triggering time will last for two minutes. After that time the LPS will be disabled, and the **PTR ENABLE** legend will disappear.

You can also abort the triggering state by pressing shortly on the MENU button.

If the LOS enters a no fire zone, while it is triggered, than the legend **PTR ENABLE** will disappear, and no fire zone legend will appear.

PTR INHIBIT

Once the LOS will leaves this zone, the LPS will be triggered again and the legend **PTR ENABLE** will reappear.

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6.3.5 Firing the LPS

If the PTR ENABLE is on the display, you can fire. Any press on the LSR button will generate a shot. As long as you press the LSR button, the LPS will fire continuously.

A flashing legend, indicating that the LPS is in fire state will appear:

PTR ON

Maximum continuous fire is also limited to two minutes. When the user releases the LSR button, fire halts and the flashing **PTR ON** will disappear.

PRT ENABLE legend will reappear. The duration of the new triggering state will be again two minutes.

Note: The two minutes duration for the triggering and fire, can be altered, via a maintenance procedure.

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6.4 Update the No Fire and Safety Zones definitions

6.4.1 Update the Safety Zones definitions

The user cannot update the **fire safety zone**. To update the value of the pitch, which represents the safety fire zone, it requires operating a maintenance procedure.

6.4.2 Update the No Fire Zones definitions

The following describes step by step, how to generate a "no fire zone" (window).

Application: No fire zone is useful when you know for sure that if you fire the LPS to this direction, its beam may hit a known object and reflects back towards a person walking by.

When you set this window, its value remains in the system non-volatile memory. When you turn off and back to on the payload, it will continue using the last set window. (Same logic as for the logic for setting the auto scan window).

Note: To generate a window, the LPS must be triggered and the legend PTR ENABLE should appear.

a. Press the AS button for 3 seconds until a legend FIRE ZONE CFG and P1 appears on the screen.

FIRE ZONE CFG

At the bottom right

P1

b. Note: Since the LPS is triggered, auto scan mode is disabled.

c. Now, slew the LOS to the upper left corner of your desired window.

d. When the LOS on the proper point, press shortly the AS button (down).

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e. The window status legend will be updated as follows:

```
P1  AZ = 25.6  EL = -10.2
P2
```

f. Now, slew the LOS to the lower right corner of your desired window.

g. When the LOS on the proper point, press shortly the AS button (down).

h. The window status legend will be updated as follows:

```
P1  AZ = 25.6  EL = -10.2
P2  AZ = 34.2  EL = -15.6
```

i. Press shortly on the AS to complete the process. The dialog box disappears

j. Now the process has been completed.

You may abort this process at any time, without its completion, by simply pressing shortly the MENU button, in.

Note: Figures above are for reference only. These numbers are referred to the POP200 central line of sight.

6.5 Using the LPS when No Fire window is Active

Whenever the LPS is triggered, the no fire zone will be displayed on the upper left corner of the screen as follows:

```
LSR  WIN  ACT
P1  25.6AZ  -10.2EL
P2  34.2AZ  -15.6EL
```

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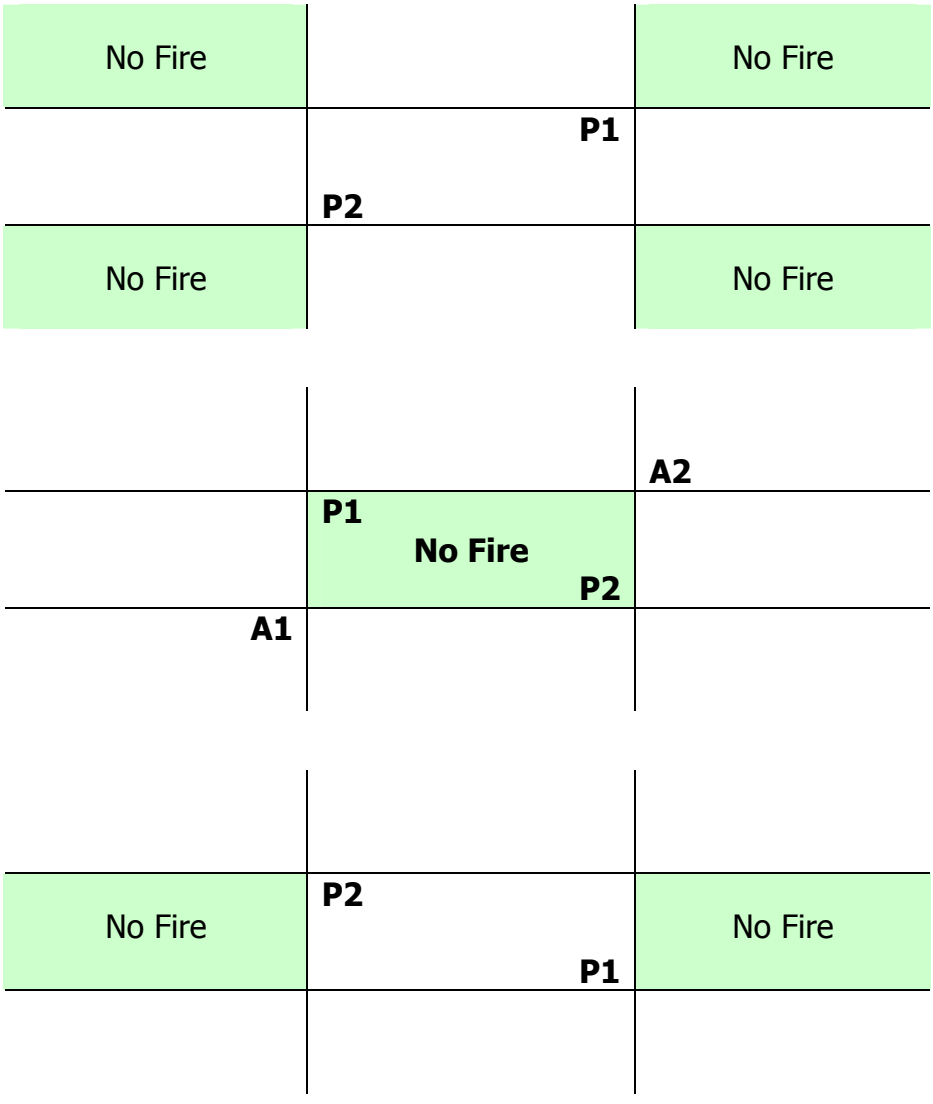
6.5.1 Canceling the "No Fire Zone".

Trigger the LPS and enter the update mode. Redefine a new window, where its two corners are identical. (Simply do not slew the LOS after you define the first point). In other words, when you see P1, hit three times shortly on the AS button.

6.5.2 Definition of a reversed "No Fire Zone".

You may define a reverse "no fire zone" window. A reverse window is a window where firing the LPS is permitted only in this window. Do so by defining first, P1 to be the lower right point and secondly, P2 as the upper left point.

Various "NO FIRE ZONE" definitions as a function of the order of definition P1 (or A1) and P2 (or A2):



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6.5.3 LPS Abort, Modes.

You may abort trigger state by pressings the MENU button IN.

The LPS will not be active (not triggered, nor fire) in any one of the following modes of operation.

- Standby.
- Auto Scan.
- Cage (pilot window).
- Stow.
- Image freeze.
- Menu.
- No reticle (if the center cross layer is removed)

6.6 Symbology Glossary Updates for LPS

Refer also to Table 10-1.

Table 6-1. LPS Symbology Glossary

No.	Item	Symbol /Text	Description
30	LPS trigger state	**PTR ENABLE**	Indicates that the LPS is in a trigger state.
31	LPS fire state	**PTR ON**	Indicates that the LPS is firing. This is a flashing legend.
32	No fire zone	**NO FIRE ZONE**	Indicates that the LOS is pointing onto a section that is predefined as a section that you cannot fire to this direction.
33		**PTR INHIBIT**	The LOS had entered a window or section where fire was selected to be disabled.
34	No fire zone parameters	**P1**	Upper left corner of no fire zone (window)
		P2	Lower right corner of no fire zone (window)
		P1 AZ= 25.6 EL= -10.2	Detail coordinates of the LPS no fire window.
		P2 AZ= 34.2 EL= -15.6	
35		**LSR WIN ACT**	Indicates that the LPS is triggered and also there is an active no fire window.

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7 Modify the System Default values.

The POP200/300 payload has several parameters, which there values come as preset from the production line. Some of these may be modified as it may be required by specific application or system usage.

7.1 CAGE Pointing Direction.

You may modify the selected cage direction of the turret see section. 2.4.8. The result of the new selected value is stored in the system nonvolatile memory and will be used after power recycle until next modification.

Reason: Selecting a new direction may be required if the user wants to select a **specific known point** where he or she are familiar with within the scene. Point like this may be the UAV front wheel or a known object fin the scene for stationary application. So if losing spatial orientation, selecting CAGE will bring the system to known scene.

7.2 AUTO SCAN

You may modify the size and location of the window and speed, which the system is using to sane in the auto scan mode. For details see section 2.4.7. The result of the new selected values are stored in the system nonvolatile memory and will be used after power recycle until next modification.

Reason: Selecting a new window or new scanning speed may be required if the user wants to select a **specific known window** where he or she are familiar with within the scene.

7.3 Fine Tune of DTV Shutter Speed (POP200).

You may change the current DTV shutter speed. Shutter speed is constant value. Its default value is 1/60 of a second, which is also the highest (slowest) value.

Reason: Under bright and shiny conditions, you may want to increase speed.

When the DTV is set as a prime output channel, click on the GAIN toward UP to increase speed, or DOWN to decrease speed. (It is possible also to transmit gain commands, via the payload uplink channel).

Any time you zoom or focus manually the DTV, the current shutter speed will be displayed for 6 seconds – provided it is not the default value of the DTV.

The last set value is memorized in the system non-volatile memory for uses after power recycle. See also 3.1.

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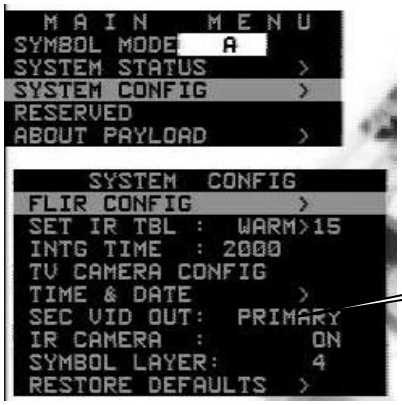
7.4 Secondary Video Output Source



You may change the setting of the video source of the secondary video output channel. Do this via the system menu option. For detail see 2.8.

The last set value is memorized in the system non-volatile memory.

7.5 Symbology Hue

You may change the setting of the overlay symbology hue. For detail see section 4.2.

Reason: To make the symbology visible under different background conditions.

If you select to do this via the menu option the last set value is memorized in the system non-volatile memory. Changing the hue directly via the menu button – HUE is quicker and the last selected value is NOT memorized.

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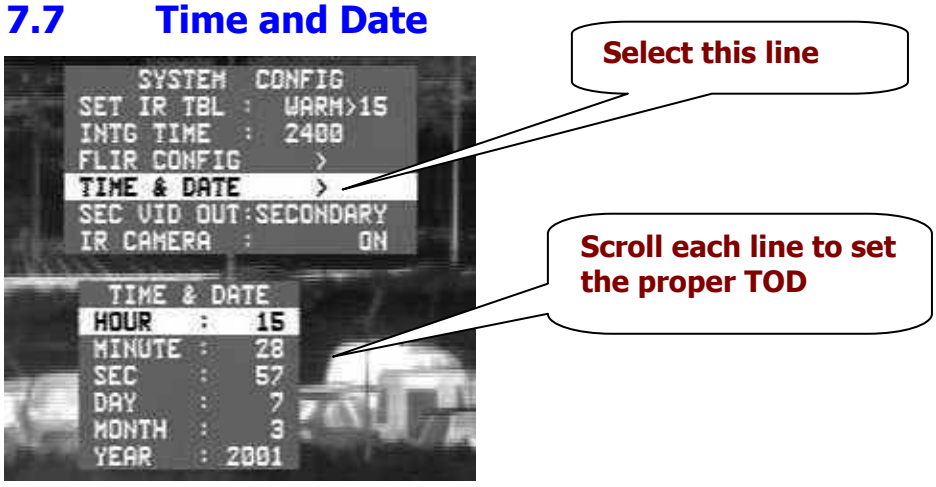
7.6 Automatic One-point NUC Correction - Direction

You may change the setting of the selected LOS direction, where it will point in the FLIR automatic, external one point correction. (The automatic, external one point correction is described under 3.1.10).

Press the TURRET mode button toward STW for at least 6 seconds, or press and wait till the legend AT NUC CFG appears.

1. Release the button.
2. Slew the LOS using the FT, toward the direction where the desire target reference is located.
3. Do that by viewing the image on the FLIR monitor.
4. When you done, press **shortly** the NUC button.
5. The coordinates of the LOS are memorized (same logic as setting new CAGE direction).
6. The FLIR starts to perform external one point correction. When it finishes the LOS returns to its original direction – just before start of the process.

7.7 Time and Date



You may modify the current time and date (TOD) which is displayed on the image bottom left.

Reason: If the payload is deployed for operation, in a new time zone.
Modify the TOD via the menu option. The last set value is memorized in the system non-volatile memory. See details at 10.6.

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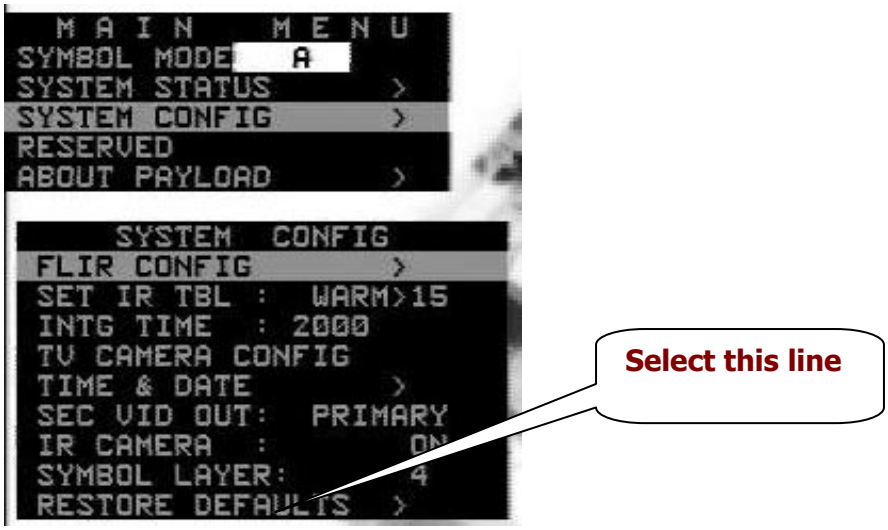
7.8 Restore Defaults.



Select this option will bring back to use the several default settings of the system. This option is selected through the line item of the MENU:

- CAGE direction.
- Auto Scan (AS) window.
- FLIR NUC table.
- FLIR integration time.

7.9 Laser Range Finder (LRF) No Firing Zone Definition.

You may modify the size and location of the window that the LRF is prohibited from firing to. For details see section 5.4

Reason: To add degree of freedom to the user, to select this window under changing of operating conditions.

7.10 Laser Pointer (LP) No Firing Zone Definition.

You may modify the size and location of the window that the LP is prohibited from firing to. For details see section 6.4.

Reason: To add degree of freedom to the user, to select this window under changing of operating conditions.

Note: this would not affect the setup of the LPS non firing safety zone.

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8 Slaving Modes of the Payload.

8.1 POP200 Operation with Nav. System (GPS).

POP200 operation with two HCGs is applicable for the following SW versions:

- Turret #12 or Higher.
- Slice #16 or Higher.
- HCG #11 or Higher.

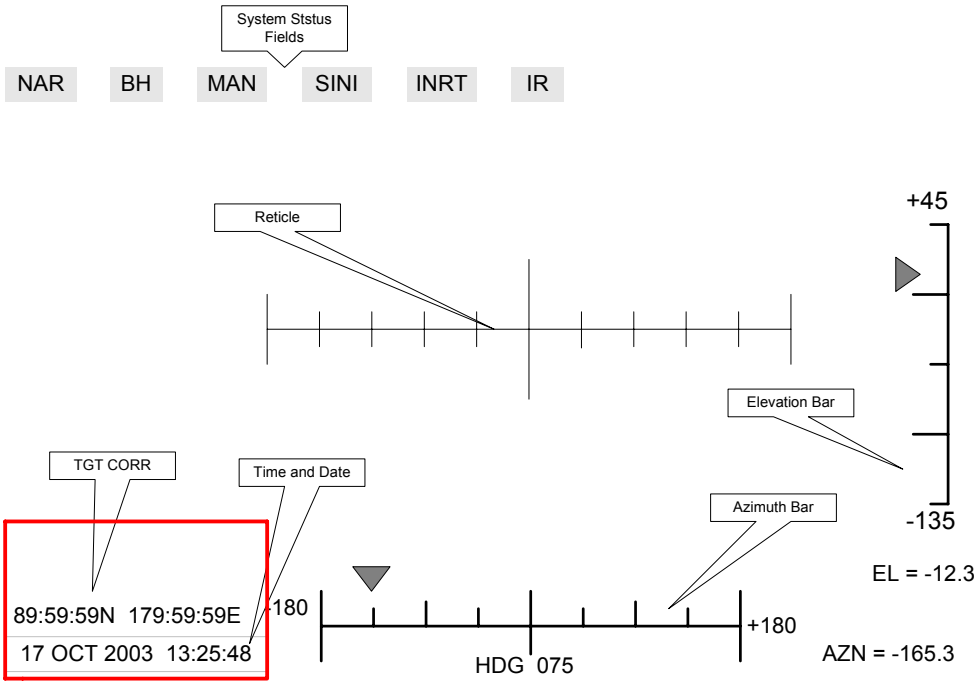
8.1.1 General

POP200 system may be configured to operate with Navigation system, typically GPS. A special set of cables and installation kit is required to interface between the payload and the navigation system.

The payload uses the present position (PP) and time stamp data of the GPS, to overlay it on the video of the POP200. PP data may appear automatically on the TV monitor if GPS sensor is valid and all connections are OK.

As long as the GPS is active and OK, the POP200 TOD is synchronized with the GPS data.

If the GPS or its connection to the POP200 system fails, than PP will disappear. Nevertheless, time and date will continue to be displayed, based on the internal clock of the POP200 system.



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8.2 POP200 Operation with RADAR.

POP200 operation with two HCGs is applicable for the following SW versions:

- Turret #12 or Higher.
- Slice #16 or Higher.
- HCG #11 or Higher.

8.2.1 General

POP200 system may be configured to operate with RADAR sensor. A special set of cables and installation kit is required to interface between the payload and the RADAR.

The payload uses radar data in order to slave its LOS towards the RADAR pointing direction.

8.2.2 Data Formatting

The following data is presented on the POP200 system video:

	Notation	Format	Units
Craft heading	HDG	###.#	Degrees
RADAR Target Bearing	BRG	###.#	Degrees (*)
RADAR Target Range	RNG	###.#	NM (**)
RADAR Target Number	NUM	##	

(*) Data units of bearing may be set to other units: Head Up (H) or Course Up (C).

(**) Data units of range may be set to other units: Kilometers (K) or Status miles (S), by using a maintenance procedure of the POP200.

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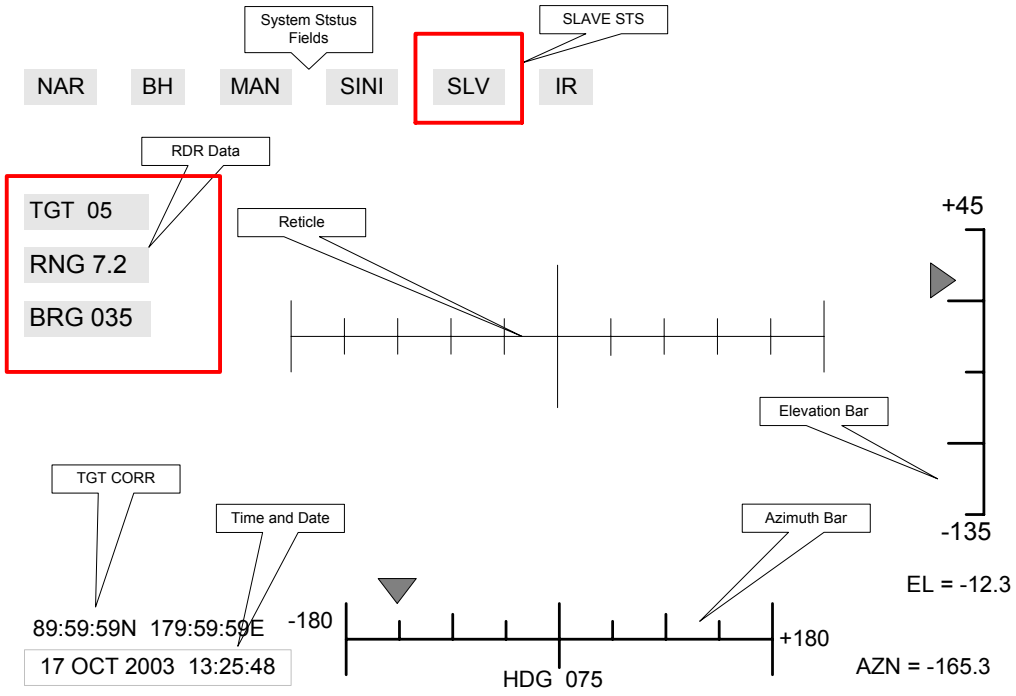

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8.2.3 Operation

All operation herein, refers to the HCG, which was selected to control the payload.

Craft heading **HDG** will appear automatically on the TV monitor if RADAR and compass sensors are valid and all connections are OK. This is regardless whether the user entered slave mode.

8.2.3.1 Slave to RADAR

SLV

Press shortly on the HCG sensor mode switch – to the **SLV** position. If RADAR is valid the POP200 system line of sight (LOS) will move and point to the first RADAR target, which is by definition as the cursor.

During the LOS movement the legend **SLAVE** will appear flashing on the POP image. Once the LOS is settled on target the legend will be displayed permanently.

You may select to slave to the **next** target, which is in the RADAR list, by short press on the **SLV** button.

Once the LOS have its slave position on the target, the following data will appear on the payload image (upper left):

- **SLAVE** legend on the turret status field.
- Target bearings, in degrees
- Target range, in NMs
- Target sequential number on the radar list.

8.2.3.2 Slaving the POP to a specific Target.

You may slave the payload LOS to any target, which is on the RADAR list, providing that the RADAR has an updated data on it. The CURSOR position is a "target" as well, and will always be the first target to slave to.

If you wish to slave to another target, simply click on the SLV button. The LOS will move to the next target on the RADAR list. Every click will cause the LOS to skip to the next target in the list. The order in which target are selected is sequentially.

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> **Note**:
>
> You cannot select a specific number in the list and force the LOS to go there. You have to cycle each target in the valid list. Nevertheless you can click on the HCG **SLV** button in a one second interval and reach quickly the target you with to salve to.

Where does the target will appear on the payload video image?

The payload LOS will go in AZIMUTH to the expected target bearing and the LOS elevation will be approximately –0.5 degrees. You may adjust this pointing direction, see next.

8.2.3.3 Exit Slave mode

You may exit SLAVE mode at any time by short press on the INR/POS button on the HCG (which is currently in control of the payload).

If you select to do so, the system will enter INERTIAL mode, keeping all the current parameters.

You may also enter to track mode during slave. If you do so the system will exit slave mode.

8.2.3.4 Adjust LOS Pointing on target.

You may adjust the LOS pointing direction – during slave mode. Just press the HCG LOS slew button to the required direction and move the LOS. Slaving to the target will continue, with the current adjustment that has been entered by the operator.

Once you skip to the next target, this adjustment will be cleared.

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8.2.4 Slave Attitude Error Calibration.

In case that there is a fixed error between the RADAR LOS and the POP200 LOS, as a result of installation or any other factor. You may minimized or eliminated the error completely. Perform slave calibration procedure as follows. It is recommended to perform this procedure in the FLIR NFOR or DTV NFOV.

Note that you must have a valid RADAR target to perform this calibration:

- Enter slave mode by a short press to the SLV.
- Verify that the payload LOS is slaved, and that all relevant RADAR data is displayed.
- Press continuously on the SLV for at least 7 seconds. The POP200 system will enter slave calibration process:
- The legend **SLAVE-CAL** will appear on the turret status field.
- Identify in the scene the target that the RADAR is lock on to. Identify the very same target on the payload image on the monitor.
- Use the HCG slew button to slew the LOS to the RADAR target, so the target will appear on the image cross (reticle).
- Exit this mode by a short press on the SLV button. The legend **SLAVE-CAL** will change to **SLAVE**.

You are now in a normal slave mode.

The calibration bias data will remain in the POP200 nonvolatile memory, also after power recycle. It will be used as a fixed bias during slave to any target, from now and on, until a new procedure will take place.

8.2.5 General Guidelines

You cannot enter payload LOS slave mode if the POP200 is in one of the following modes of operation:

- Standby (**STBY**)
- Initialization (**TINI** or **SINI**).
- Payload is lasering (pointer or LRF).
- System in **CAGE** or **STOW** mode.
- System in **MENU**.
- System is performing non uniformity correction (**NUC**, or **AT NUC**).

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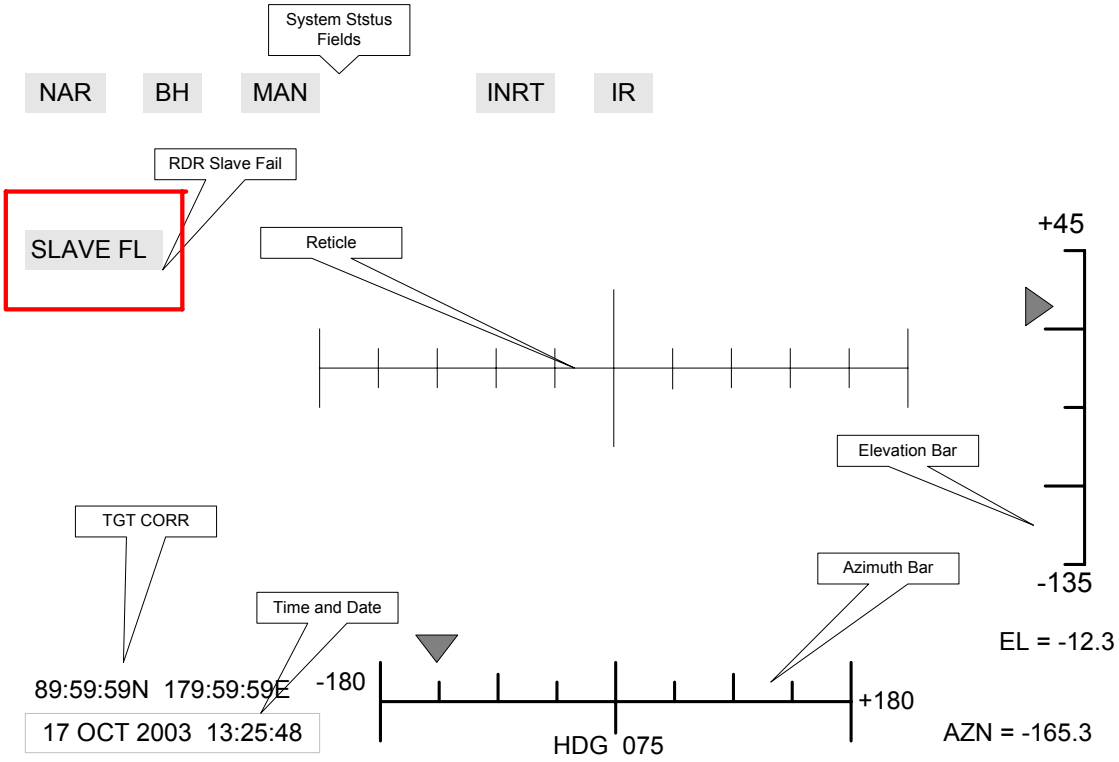
8.2.6 RADAR Fail or Off.

If the user has selected to enter salve mode while the RADAR is inoperable, than the payload will not enter slave mode. The legend **SLV-FL** will flash on the video image in the upper left section of the image, for 7 seconds.



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8.3 POP200 Operation, With Two HCGs.

POP200 operation with two HCGs is applicable for the following SW versions:

- Turret #12 or Higher.
- Slice #16 or Higher.
- HCG #11 or Higher.

8.3.1 General

The POP200 may be configured to operate under the control of two HCGs. However only ONE HCG will control the payload, at a time. One HCG is defined as a primary (Master) HCG, the other as a secondary (Slave) HCG.

You may also refer to the master HCG as the **console** HCG and the slave HCG as the **radio** HCG.

8.3.2 Power up and priority.

ON-OFF switch

Amber Light

If power is applied properly to the system, the HCG amber light on the two **HCGs** will light with **orange**. (when the HCG ON-OFF switch is still in the OFF position).

Set the ON/OFF switch on the master HCG to STBY. Wait one second and then set it to ON. The primary HCG will take command on the payload. The amber light on the master HCG will be **green**, while the amber light on the slave HCG will flash **green**.

Note: You may leave the ON-OFF switch of the slave HCG in the OFF position.

In this mode the master HCG, controls the payload. The slave HCG has no effect on any of the controls.

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8.3.3 Switch control between the HCGs.

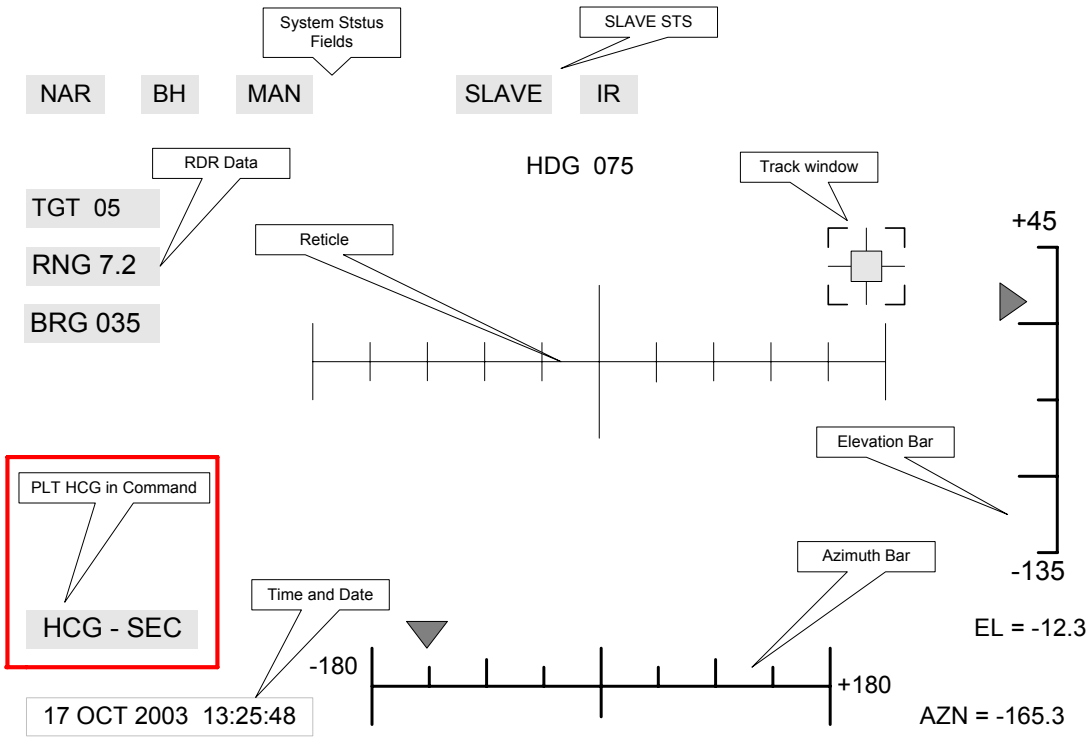
Freeze

To transfer command on the payload, from the master HCG to the slave HCG, press on SLAVE HCG the sensor mode button, to the **FZ position – for at least 2 seconds.**

When the transfer has completed, a legend **HC-PLT** will appear on the display, bottom left, indicates that the control is given to the slave HCG.

The master HCG light will then flash **green**. The slave HCG will light green continuously, indicating that the slave HCG is in command on the payload.

To regain control to the master HCG, press on the MASTER HCG, the sensor mode button, to the FZ position – for at least 5 seconds. When the transfer of the control has completed, the legend HC-PLT will disappear.



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9 Non-uniformity Correction

9.1 Background

This operation is designed to improve the FLIR camera image quality. Usually there is no need to perform this correction. The system is calibrated properly during production at TAMAM. The correction values that where done during production, are stored in the system non-volatile memory in the form of tables, overall three tables. These values are optimal and are being loaded at each power up of the system.

The propose of the correction during payload production is to calculate a set of coefficient for all pixels on the array, so each pixel on the screen will produce an electrical voltage identical to the other one, for the same input radiation intensity (identical uniformity upon the whole detector). This operation is performed by a GAIN and OFFSET coefficients calculation for each individual pixel. The calculation of these coefficients requires initial data in two different background temperatures. This refers as "two-points non uniformity correction", factory set tables.

Under user operation, if he or she thinks that FLIR image quality can be improved, he can perform "one-point non uniformity correction", by using one of several techniques to do so. However this correction is valid only for this session of operation. Recycling system power will clear the user correction. If the user wishes to restore back the factory set tables he may use the "set factory table" option in the MENU to bring back the factory tables.

The user can correct in one of two ways:

a. **Internal:** Use an internal to the payload NUC target, with a uniform temperature, shaped as disk and hidden in the turret. If the internal NUC plate temperature is above 38°, then internal NUC will not be allowed.

b. **External:** Use external target boards with uniform temperature, which is located outside the payload, in front of the IR window. It is preferred that the target board temperature will be close to the observed scene temperature (not more than ±10°c).

The palate used for the external correction should cover completely the IR window entrance. Typical alternatives of "plates" for the external 1-point NUC, may be: (a) Surface of the sea or lake, (b) Clear sky (c) Desert, or any scene that may be relatively uniform by defocusing.

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✖ CAUTION

Do not place the system in the NUC mode unless it is absolutely necessary. Degraded system performance may result. This may require power to be recycled, or using the menu option "Restore NUC Factory Tables".

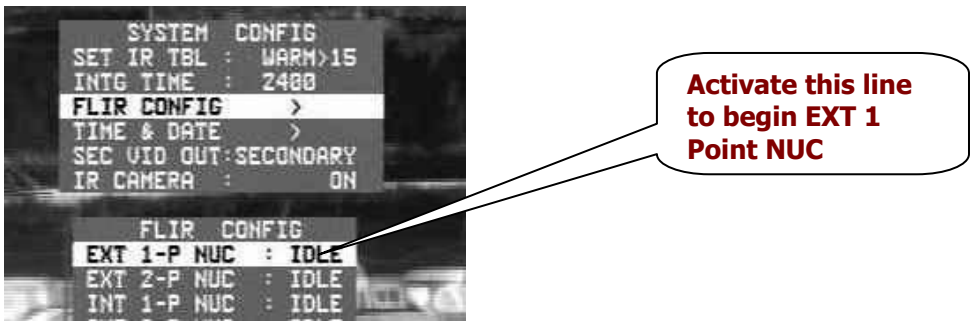
The system stored three tables for NUC that were calculated while producing the unit. These three tables should cover most of the operating range of the payload.

- Table for "warm" background, above (approximately) +15°
- A table for "cool" background, in range of (approximately) +5° to +20°
- A table for "'cold" background, under (approximately) +10°
- **Background** = the temperature of the scene, NOT of the target.

⌦ Note

If a non-uniformity correction was performed, its data is saved only for present power cycle.

9.2 User Correction 1- Point External (Preferred).


SYSTEM CONFIG
SET IR TBL : WARM>15
INTG TIME : 2480
FLIR CONFIG >
TIME & DATE >
SEC VID OUT:SECONDARY
IR CAMERA : ON
FLIR CONFIG
EXT 1-P NUC : IDLE
EXT 2-P NUC : IDLE
INT 1-P NUC : IDLE
Activate this line to begin EXT 1 Point NUC

⌦ Note

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This mode is applicable only when it is possible to point the Payload IR window, towards a reference uniform background, such as clear sky, sea, or a plate.

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For external NUC: Always perform it in NFOV

a. Prepare a black or smooth non-reflective black plate, if not, slew the LOS to the reference background (Sky, sea ground or plate).

b. Verify that the plate temperature closes the temperature of the background scene – but not above 15°.

c. Set the FLIR to NARROW FOV and FOCUS to FAR..

d. Enter MENU and scroll to submenu FLIR CONFIG. (Use figure 8-1).

e. Highlight the first line: EXT 1-P NUC.

f. Press the FT right, for SET. The system prompt you to put the reference target in front of the IR window. Observe the following:

COVER THE IR LENS WITH BLACK BODY PRESS SET TO EXECUTE.

g. Press again the FT right, for SET.

h. Process starts automatically. If using a plate, hold the plate against the window (about 10 seconds) till end of process. Do note move the plate while NUC in process.

i. At the end of the process, access to menu is regained.

j. Exit menu in a normal way. process causes NUC execution.

↑ Tip

If there is a doubt about the non-uniformity correction quality, it is possible to "bring back" for use the table that was prepared during the unit production. (RESTORE FACTORY TABLE) from MENU.

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Figure 9-1. 1-Point External, using MENU Procedure

9.3 User Correction 1- Point, Internal.

This mode may be used only if there is a clear need to perform NUC and there is no possibility to perform the process using an external target.

a. Press on STOW pushbutton shortly and bring the Payload to STOW position. Verify STOW legend on the turret status field. The Payload LOS moves towards STOW position (90° elevation, 180° Azimuth).

b. Select the FLIR MEDIUM FOV.

c. Press again on STOW pushbutton for at least 3 seconds continuously. Pay attention to the following process:

   1) NUC legend replaces the STOW.

   2) The FLIR is performing correction during 10 to 30 seconds. During this period the image is frozen.

d. At the end of the process, the line of sight goes back to its last pointing attitude where it was before starting the correction.

e. You may also start the process prom step (c) above. Just make sure before that you are in the FLIR MFOV. If the FLIR is NOT in the MFOV or the internal reference plate temperature is above 40 degrees the process will be rejected.

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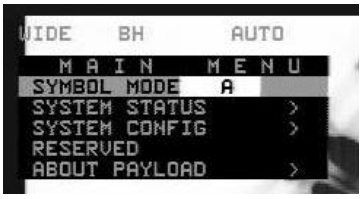
10 System Menu

10.1 General Description



This mode enables the user to choose and alter several POP200 operational options. It is recommended not to modify those options, unless the user or the operator is familiar with each option and knows what to expect to when he or she makes the alteration. See figures 9-1 and 9-2 for a typical menu images.

10.2 Entry and Exit.

Press shortly the MENU button in (or send the proper command to the payload via the uplink channel). The first menu appears.

While at MENU the FT is used to move the highlighted cursor and will not enable LOS movements.

- Use the FT to Scroll up or down to select a menu item.
- For the approval of the modifications you made or have selected, leave menu by shot press on the MENU button. Some alterations will ask you to save before continue, response as required.
- While in menu mode, the tracker, LRF, LOS slewing and LP (if applicable) are disabled.

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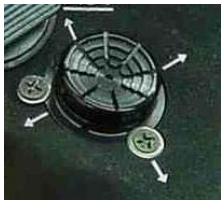
10.3 How to Navigate within the Menu.



Use the FT to up and down directions, to scroll the highlight up or down. A right side arrow, indicates that there is a submenu to continue: **>**

If you wish to select the submenu, highlight the line and press the FT right. Leave any submenu by short press on the MENU button.

If you are prompt to go through the SAVE option, note that the default highlighted line is the ABORT (not the SAVE). Scroll up to highlight the SAVE and than press the MENU button to confirm the SAVE.

Some action will result with a WAIT response. Be patient and wait! Usually the WAIT will not last for more than 5 seconds.

10.4 How to Control the MENU in a Remote Host Operation.

All the menu and submenu lines, are accessible via the payload uplink protocol (roll fields), so the developer of the SW application can mimic the FT action while it is in the MENU mode.

10.5 Most Common Lines in MENU Mode

Section 10.6 describes in details each line menu. However the most common functions to use MENU for are:

a. Time and date modification

b. External 1-P NUC : option for advanced…

c. Read system status.

d. Turn the FLIR to OFF (or ON).

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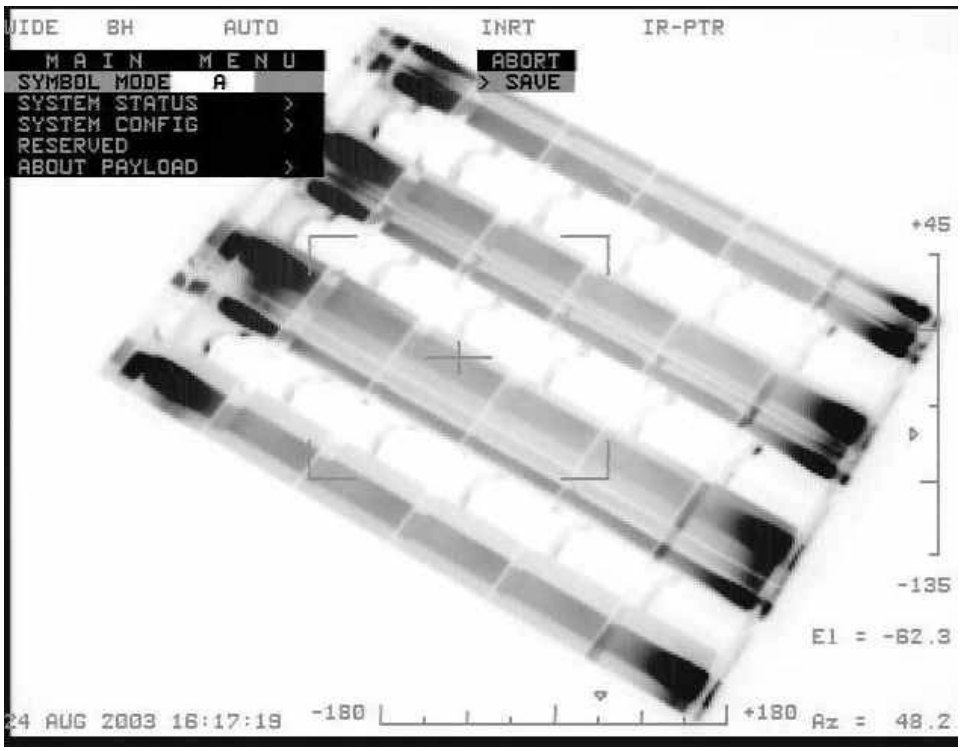
System MAIN MENU (Opening menu)



System STATUS Sub MENU

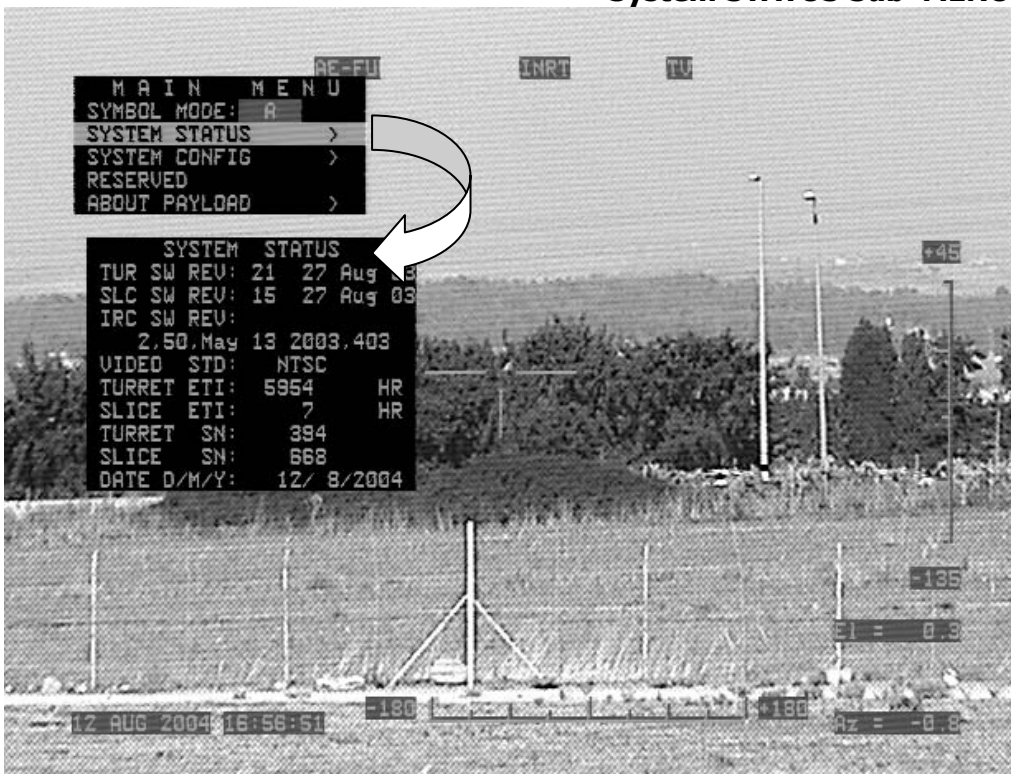


Figure 9-1 system MENU Options

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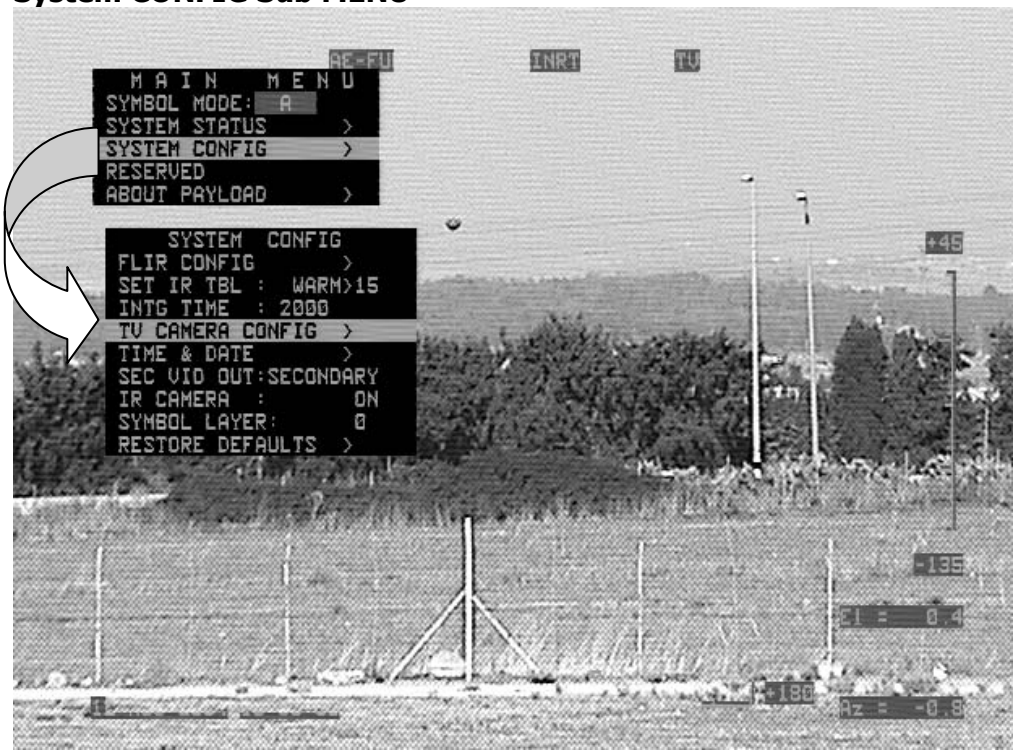
System CONFIG Sub MENU



System FLIR CONFIG Sub MENU

Figure 9-2 system MENU Options

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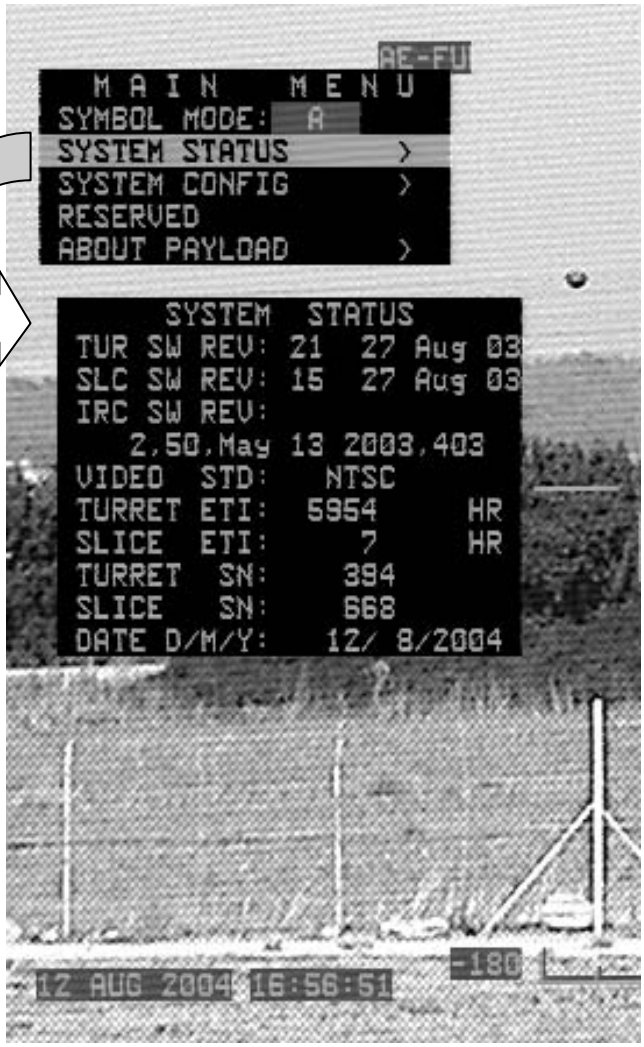

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10.6 MENU Detailed Description

MAIN MENU		Description
SYMBOL MODE	**A**	Selects one of several options for the symbology hue. The A symbol represents the current selected hue. To select a hue, role forward or backward, and exit with SAVE (or ABORT).
SYSTEM STATUS	**>**	Describes the POP200 current H/W and S/W configuration.
SYSTEM CONFIG	**>**	Enables access to several options for system settings.
RESEREVED		Line reserved for future growth
ABOUT PAYLOAD	**>**	Describes highlights of the system characteristics.

> Indicates that there is a submenu under this line.

		Description
> ABORT		Enables the user to exit update parameters mode without saving the changes.
SAVE		Enables the user to exit update parameters mode after saving the changes.

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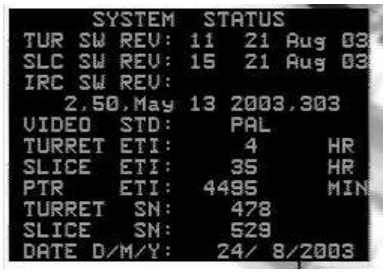

SYSTEM STATUS		Description
TRT SW REVISION	**11**	Indicates the current TURRET controller SW version (Number here is for reference only). Turret V#11 and higher supports also the displays of SW compilation date.
SLC SW REVISION	**15**	Indicates the current SLICE controller SW version (Number is for reference only).
IRC SW REVISION	**2.50.303**	Indicates the current IR camera controller SW version (Number is for reference only)
VIDEO STD	**NTSC**	Indicates the payload video standard format (both IR and the TV channels).
TURRET ETI	**4 HR**	Indicates the elapsed turret operation hours (see notes 1, 2).
PTR ETI	**4495 MIN**	Indicates the total time that the laser pointer (if applicable) was activated.
SLICE ETI	**35 HR**	Indicates the elapsed slice operation hours (see notes 1, 2).
SLICE SN	**203**	Indicates the current slice's serial number (see note 2).
LRF SHOTS	**4520**	Accumulated number of LRF shots.
DATE	**02/10/2000**	Current date.

Note 1: Number is incremented every 15 minutes.
Note 2: These numbers are updated during system power up.

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SYSTEM CONFIG		Description
FLIR CONFIG	**>**	Enables to access and alter various FLIR features.
SET IR TABLE	**WARM > 15**	Indicates the current IR NUC table that is in use. Enables to put into use one of the three IR NUC tables. The other line options are = **5 < COOL < 20** **COLD < 10** Default = **WARM > 15** (See note 1)
INTG TIME	**2400**	Indicates the current FLIR integration time (in microseconds), that is in use. (Number is for reference only) The user can set number. See note 2. Can be incremented or decrement in a quantum of 0.1 milliseconds.
TV CAMERA CONFIG		Not used. Reserved for future growth
TIME & DATE	**>**	See details in the Configure line.
SEC VID OUT	**SECONDARY**	Enables to set the output of the secondary video to be one of two options: Secondary or Primary. The other line option is = **PRIMARY** Default = **SECONDARY** See note 3
IR CAMERA	**ON**	Enables to turns the IR camera to OFF - by shutting down the COOLER. The other line option is = **OFF** Default = **ON**
SYMBOL LAYER	**0**	Enables to scroll between the symbology layers. See 4.1. This function is equivalent to clicking the SYM button on the HCG. Other line options are = **1, 2, 3, 4, 5**
RESTORE DEFAULTS		Selecting this line will restore system defaults. See 8.8.

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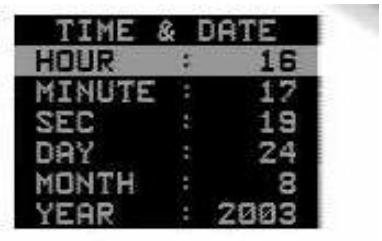
Note 1: Numbers indicates the recommended table to use, in accordance of the scene temperature.
Note 2: If the user changes IR integration time significantly, it is recommended to perform NUC 1-P.
Note 3: SECONDARY = The video output of the POP200 secondary channel.
PRIMARY = The video output of the POP200 secondary channel.



Time is in a format of HH.MM.SS
Date is in a format of DD.MM.YY

T I M E & D A T E		Description
HOUR	**18**	Indicates the current hour. Number can be incremented or decrement by units of 1.
MINUTE	**54**	Indicates the current minute. Number can be incremented or decrement by units of 1.
SEC	**36**	Indicates the current second. Number can be incremented or decrement by units of 1.
DAY	**26**	Indicates the current day of the month. Number can be incremented or decrement by units of 1.
MONTH	**11**	Indicates the current month. Number can be incremented or decrement by units of 1.
YEAR	**2001**	Indicates the current year. Number can be incremented or decrement by units of 1.

Note 1: Exit this menu will set the system TOD to these menu values.

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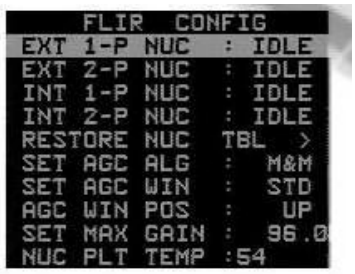
FLIR CONFIG
EXT 1-P NUC : IDLE
EXT 2-P NUC : IDLE
INT 1-P NUC : IDLE
INT 2-P NUC : IDLE
RESTORE NUC TBL >
SET AGC ALG : M&M
SET AGC WIN : STD
AGC WIN POS : UP
SET MAX GAIN : 96.0
NUC PLT TEMP :54

F L I R C O N F I G		**Description**
EXT 1-P NUC	**SET**	Enables to perform NUC, mode EXTERNAL ONE POINTS (see notes 1, 2).
EXT 2-P NUC	**SET**	Enables to perform NUC, mode EXTERNAL TWO POINTS (see notes 1, 2).
INT 1-P NUC	**SET**	Enables to perform NUC, mode INTERNAL ONE POINTS (see notes 1, 2, 6).
INT 2-P NUC	**SET**	Enables to perform NUC, mode INTERNAL ONE POINTS (see notes 1, 2, 6, 7).
RESTORE NUC TBL	**>**	Enables the user to bring back to use the IR NUC factory table. The other line option is = **WAIT**
SET AGC ALG	**M & M**	Enables the user to select between two AGC algorithms for use in the IR imaging mode. The other line option is = **M & S, WAIT** Default = **M & M** (See note 4).
SET AGC WIN	**3 / 4**	Enables the user to select between four areas of window, which AGC algorithms will take data from. The other line options are = **1 / 2, 1 / 4, 1 / 1, STD, WAIT** Default = **3 / 4** (See note 3).
SET WIN POS	**UP**	Scroll between the following option of AGC window position: **UP, CENTER, DOWN.** Default is CENTER. (see note 8)
SET MAX GAIN	**96**	Limits the maximum allowable gain in FLIR auto mode to the selected value. Scroll between these values. Legal values are = **100, 96, 92, 88, 84, 80, 76** (see note 9).
NUC PLT TEMP	**26**	Current temperature (°C) of the NUC plate (see note 5).

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Note 1: The data results of the correction will override the current table in use.

Note 2: The data results of the correction are not stored in the system non-volatile memory. Recycling the power will bring back factory table.

Note 3: Position of the window is in accordance of the next line.

Note 4: M & M = Minimum and Maximum. M & S = Mean and Sigma.

Note 5: This number is "read only" and should be use as a reference for the operator before he or she tries to perform internal 2-P NUC.
Maximum readable temperature: +60°C
Maximum readable temperature: -20°C

Note 6: NUC INTERNAL requires the system to be in STOW and MEDIUM field of view. Other wise the system will prevent the user from performing the operation.

Note 7: NUC INTERNAL 2-Points requires the temperature of the reference plate of the TURRET, to be at initial temperature, lower than 40°.

Note 8: The initial setting of window position is in accordance of the user application. It is recommended not to modify this selection.
UAV = CENTER.
SEA = UP
GROUND = DOWN.

Note 9: This option is design to reduce the system background noise of the FLIR, when viewing a uniform scene.

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11 Symbology Legend and Glossary

11.1 Symbology Layout – Basic

This set of symbols refers to the POP200 dual configuration of FLIR and DTV channels.

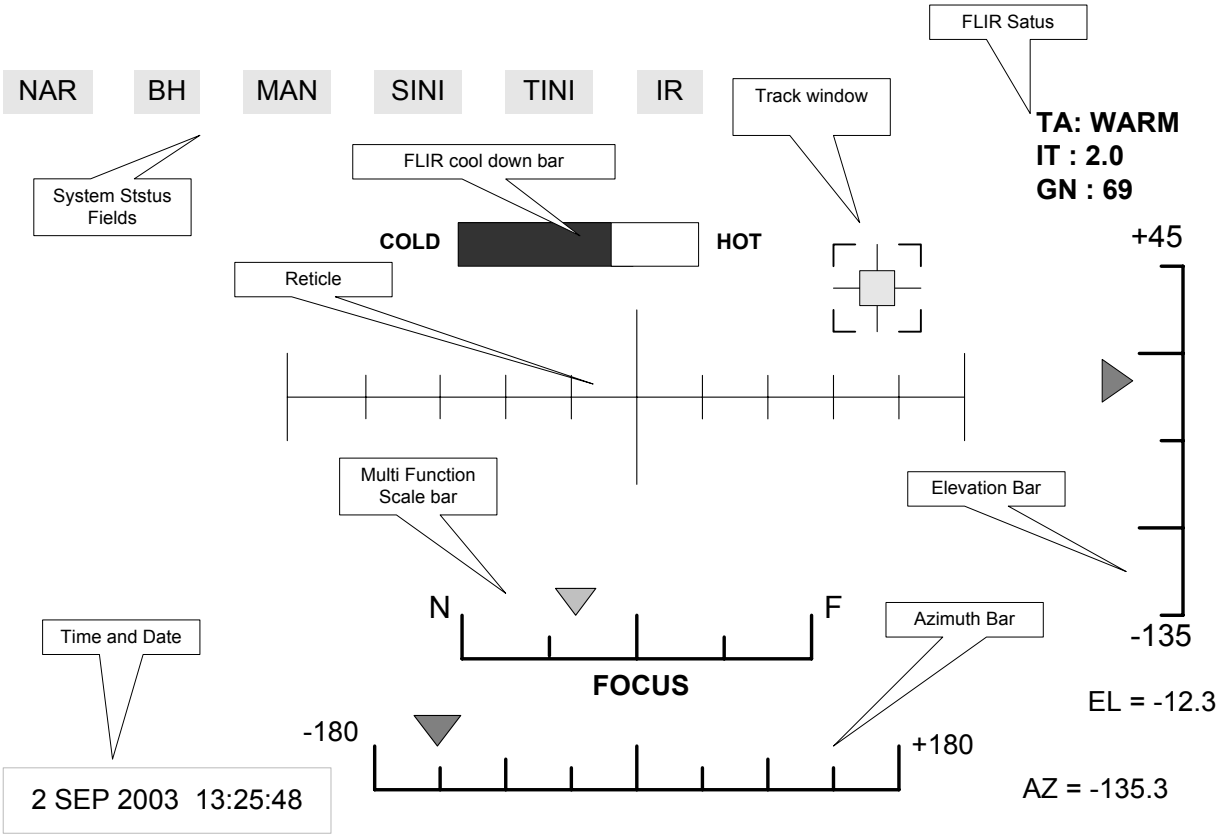

Figure 10-1. Symbology Layout – FLIR DTV.

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11.2 Symbology Layout – With LRF

This set of symbols refers to the POP200 Three sensor configuration of FLIR, DTV and LRF channels.

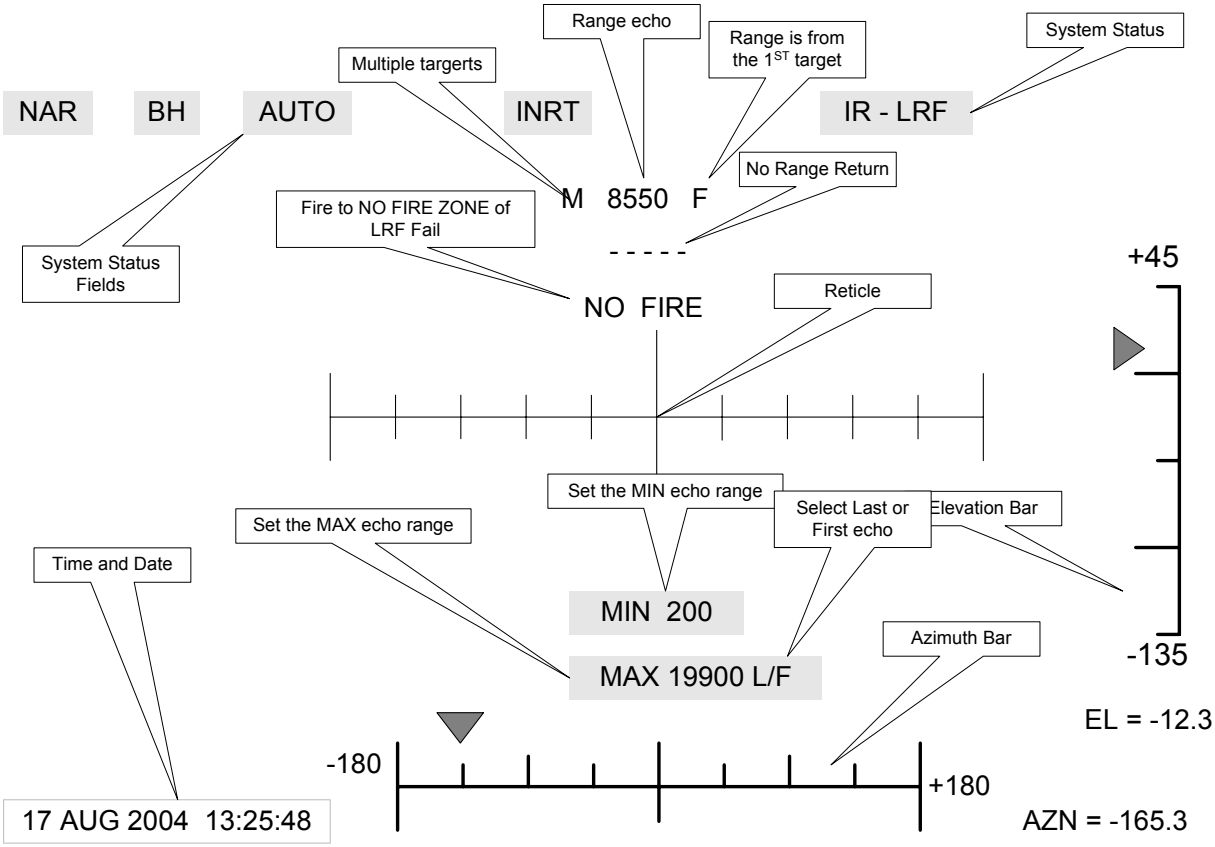

Figure 10-2. Symbology Layout – with LRF

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11.3 Symbology Layout – With Radar and GPS integrated

This set of symbols refers to the POP200, when is integrated with a RADAR or GPS sensors. (This is for slice SW version #16 or higher).

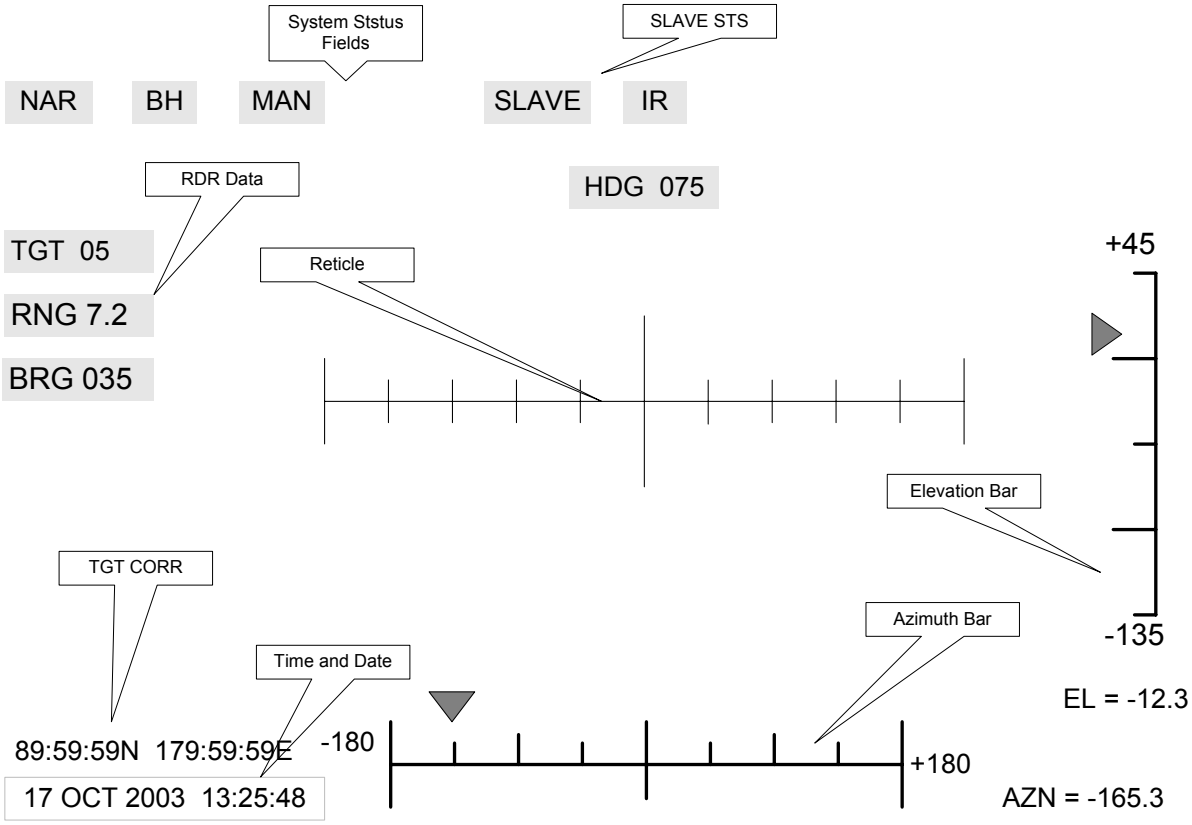

Figure 10-3. Symbology Layout – with RDR & NAV

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11.4 Symbology Glossary

Table 10-1. Symbology Glossary

No.	Item	Symbol /Text	Description
1	Field of View	**WIDE**	Indicates that the FLIR is in wide FOV position.
		MED	Indicates that the FLIR is in medium FOV position.
		NAR	Indicates that the FLIR is in narrow FOV position.
		SNAR	Indicates that the FLIR is in electronic X2 narrow FOV position.
		ELZM	Indicates that the DTV is in electronic zoom magnification.
2	FLIR Polarity	**BH**	Hot items on the FLIR image will appear black
		WH	Hot items on the FLIR image will appear white.
3	FLIR Gain/Level	**AUTO**	Gain and level values, are set automatically by the FLIR algorithm. (You may read the current gain value in the FLIR status field).
		MAN	The user sets gain and level values. (You may read the current gain value in the FLIR status field).
		AE - GAIN	The user sets gain value. Level is determined automatically. (SW Rev#16 and higher)
4	System status	**IR - LRF**	The system contains LRF sensor. (May also appear as TV – LRF)
		IR - PTR	The system contains LPS sensor. (May also appear as TV – PTR)
		IR - M	The FLIR channel contains optical magnifier
	SYSTEM STANDBY		System in STBY: Stow, no controls are available
5	Slice Status	**SINI**	**Slice Initialization**. The slice is in a middle of its initialization process. During this period it will ignore operator commands.
		SLBU	**Slice BackUp**. The slice is in a back up mode due to lost of communication with the turret. During this period it ignores operator commands.
		NUC	**Slice NUC**. The slice is in NUC mode. During this period it ignores operator commands.

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Table 10-1. Symbology Glossary (Cont'd)

No.	Item	Symbol /Text	Description
6	Turret Status	**TINI**	**Turret Initialization**. The turret is in a middle of its initialization process. During this period it will ignore operator commands.
		TSBY	**Turret Standby**. The turret is in a standby mode. This is a fully operational mode.
		TSBU	**Turret BackUp**. The turret is in a back up mode due to lost of communication with the host (or HCG). The turret will enter this mode 30 seconds after the actual detection of comm. Lost. During this period it ignores operator commands. It will leave this mode immediately after communication resumes.
		CAGE	Payload is in cage mode.
		STOW	Payload is in stow mode.
		INRT	**Inertial**. Payload is in inertial mode.
		HHLD	**Heading Hold** (position). Payload is in position mode.
		ASCN	**Auto Scan**. Payload is in autoscan mode.
		CGCFG	**Cage configuration**. Payload is in cage configuration mode.
		ASCFG	**Auto Scan Configuration**. Payload is in auto scan configuration mode.
7	Tracker	**TRCK**	System in track mode. (see details next)
		TRCK SRC	System in track search mode. (see details next)
8	Prime Channel	**IR**	**Infra-Red**. Prime video channel output is FLIR.
		TV	**Television**. Prime video channel output is Day TV Camera.

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Table 10-1. Symbology Glossary (Cont'd)

No.	Item	Symbol /Text	Description
9	Slave mode	**SLAVE**	Indicates that the LOS is slaved to RADAR of GPS
		SLAVE CAL	Slave LOS calibration process.
		SLAVE FL	LOS was not able to track the RADAR (or GPS) target.
10	FLIR Status	**TA**	**Table**. Prefix to table value (description)
		WARN **COOL** **COLD**	Three alternatives for table legend.
		IT	**Integration**. Prefix to FLIR integration (exposure) time, in milliseconds.
		CHANGE TBL?	Response to first press on the TBL button.
		GN	**GAIN**. Prefix to gain value.
		1 up to 100	Available values for GAIN..
		FREEZE	FLIR Image is frozen.
11	FLIR Cool Down Bar	**COOL HOT**	1. Length of black section, indicates time left to complete FLIR cool down 2. Full black bar for more than 10 seconds. Indicate slice internal communication problem.
		DET HOT	Detector Hot. Indication that the FLIR is not ready for imaging. Appears only on the DTV image (if applicable).

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Table 10-1. Symbology Glossary (Cont'd)

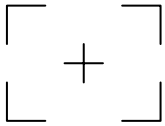
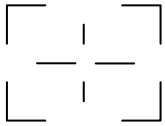
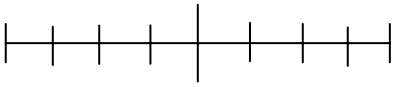
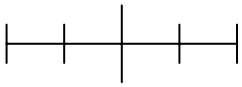
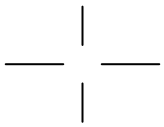
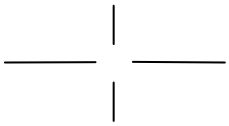
o.	Item	Symbol /Text	Description
12	FLIR Reticle		WIDE: Indicate that the FLIR is in the wide FOV. Its size indicates the FOV of the medium.
			MEDIUM: Indicate that the FLIR is in the medium FOV. Its size indicates the FOV of the narrow.
			NARROW: Indicate that the FLIR is in the narrow FOV. Gap between small vertical bars is 2 MR.
			Surer NARROW: Indicate that the FLIR is in the SUPER narrow FOV. Gap between small vertical bars is 1 MR.
13	DTV Reticle		Represents the DTV center FOV for optical zoom leg.
			Represents the DTV center FOV for electronic zoom leg.

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Table 10-1. Symbology Glossary (Cont'd)

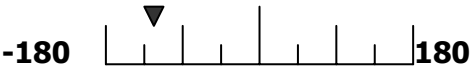
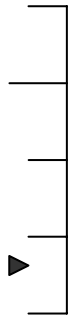
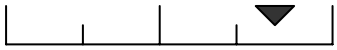
No.	Item	Symbol /Text	Description
14	Azimuth Bar 		A fixed scale of +180° down to -180°. Range between two tics is +45°. The black arrow represents the current elevation of the LOS payload.
15	Azimuth Readout	**AZ=-125.2**	Represents the current payload azimuth readout.
16	Elevation Bar	**45**  **-135**	A fixed scale of +45° down to -135°. Range between two ticks is +45°. The black arrow represents the current elevation of the LOS payload.
17	Elevation Readout	**EL=-52.2**	Represents the current payload elevation readout.
18	Multi Function Scale (MFS) 		Appears for 10 seconds, when controlling one of the following FLIR parameters: Focus, Gain, Level. The arrow represents in relative rough magnitude the actual location of the current controlled parameters.
19	MFS text	**IR FOCUS** **IR GAIN** **IR LEVEL**	Possible legend under the MFS.
		"L"	Blinking "L" indicates that the gain or level value is at its lowest position.
		"H"	Blinking "H" indicates that the gain or level value is at its highest position.
		"N"	Blinking "N" indicates that the focus is at its nearest position.
		"F"	Blinking "F" indicates that the focus is at its far position.

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Table 10-1. Symbology Glossary (Cont'd)

No.	Item	Symbol /Text	Description
20	DTV Zoom POP200		
		X8	Indicates the current DTV zoom.
			DTV Zooming or manual focus is in process.
		1 / 300	The current value of the shutter speed. Values are, from 1/120 to 1/10000 Note that the default value 1/60 is invisible.
		MAN - FOC	Manual DTV focus.
21	Enhanced DTV POP200-6		
		TV	**Television**. Prime video channel output is Day TV color Camera
		TV NIR	**Television**. Prime video channel output is Day TV Camera, in Near IR (NIR) mode
		EXP - COMP	DTV is over/under exposed.
		AE - FULL	Full auto mode.
		AE – SHTR	Shutter priority. The user selects manually the shutter speed.
		AE – IRIS	IRIS priority. The user selects manually the IRIS.
		MAN	Full manual mode. The user selects manually the shutter speed and the IRIS.
	DTV zoom scale **X29** **OPT** **ELC**		Appears for 10 seconds, when controlling the DTV ZOOM. The arrow represents in relative rough magnitude the actual zoom ratio.
		ZOOM X19	The current zoom ratio. Values are, from X1 to X45

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Table 10-1. Symbology Glossary (Cont'd)

No.	Item	Symbol /Text	Description
		FOV 34	The current FOV in milliradians. Values are, from 380 to 8.5
		SHTR 1/60	The current shutter speed. Values are, from 1/15 to 1/10000
		IRIS F16.0	The current IRIS (Aperture) value. Values are, from F1.6 to F28
		OPT X19	Zoom in the its optical range X1 to X22
		ELC X35	Zoom in the its electronic range X23 to X45
22	Date	**17 OCT 1980**	Indicates the current date.
23	Time	**07:12:00**	Indicates the current time.
24	Automatic external 1-Point NUC	**AT NUC**	Indicates a selection of a process of automatic external NUC.
		A NUC POS	LOS reaches its pointing position against the reference NUC target.
		A NUC CFG	Indicates a process of configuration the LOS reference point for automatic external NUC.

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Table 10-1. Symbology Glossary (Cont'd)

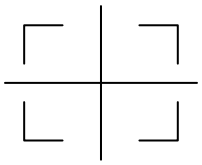
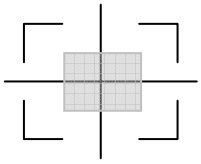
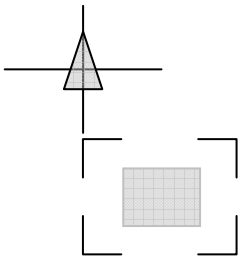
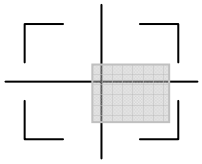
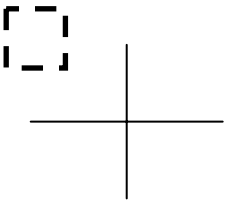
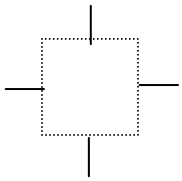
No.	Item	Symbol /Text	Description
25	Tracker command		Appears immediately after lock command.
	Tracker lock		Appears immediately after lock succeeded. Indicates a target in the image.
	Tracker search		When trying to acquire a new target, while continuously tracking the original one. Indicates a new target within the FOV.
	Track Adjust		Adjusting the reference tracking point – on the target.
	Prediction		Appears if track is lost. Payload will attempt to predict the location. If it find it will try to relock. Symbol lasts for 3 seconds.
	Track loss		Appears after tracker gave up prediction. If the payload find a target it will try to relock. Symbol lasts for 3 seconds.

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Table 10-1. Symbology Glossary (Cont'd)

No.	Item	Symbol /Text	Description
26	LRF	**M 8550 F**	M: Multiple targets were received.
			The range is 8550 meters
			F: The echo that its range is displayed, comes from the **FIRST** echo.
			Also possible L: Echo from the **LAST** target.
		-- -- -- -- --	The LRF had fired, but no echo was received.
		NO FIRE	The LRF was not able to fire: (a) LRF fail or (b) Fire into forbidden zone.
		MIN 200	The minimum range to read is ….
		MAX 19900	The maximum range to read is ….
		IR(TV)-LRF	Payload configured to LRF
27	Laser Pointer	**PTR EN**	The LPS (Laser pointer) is triggered.
		INHIBIT	You are trying to fire a pointer into forbidden zone.
		IR(TV)-PTR	Payload configured to LPS
28	System Slave	**P 89:59:59 N**	Present position N
		P 177:48:52 E	Present position E
		T 89:59:59 N	Target Position N
		T 177:48:52 E	Target Position E
		TGT 05	The target which slaves the LOS (number 5 in the RADAR list)
		RNG 7.2 N	Range to target is 7.2 Nautical miles. Other measurements: **K**: Kilometers **S**: Status miles.
		BRG 035 N	Bearing to target is 35 Degrees, North relative. Other relatives measurements: **C**: Course up. **H**: Heading up.
		HDG 183.7	Craft heading to target is …
29	Operation with 2 HCGs	**HCG SEC**	In case of the use of two HCGs: Means that the observer HCG, becomes slave.

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12 BIT

12.1 Turret BIT

The turret has an initiated BIT capability as follow. Activate it by pressing the INT/POS button on the HCG or sending the command continuously, for 4 seconds. The process will start automatically with the legend IBIT on the display.

During the test the line of sight moves to a number of places that are pre-defined for the software. In the end of the process it returns to "operator window" (the last one where we had been).

The process is composed of the following steps, see table 12-1. In each point the system stops for a moment and continues to the next point. The maximal time for the test performance is about 2 minutes.

The success of the test is, when on the EL and AZ cursors appear correct values for the angles.

Table 11-1. BIT Steps

Step	Position	EL	AZ	Notes
1	Begin from any position			
2	STOW	+90°	+0°	
3	NADIR	-90°	+0°	
4	Full traverse to the right	+0°	+360°	Full turn to the right
5	Full traverse to the left	+0°	-360°	Full turn to the left
6	Back to "operator window"			

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13 Tips and Tricks

Expert users who are aware to what they are doing may (should) use the following functions!

13.1 Display the Mean and Sigma of the FLIR.

Expert users should use this function.

Description: You may display momentarily the FLIR MEAN and SIGMA of the current snap of the scene. The data will appear in the following form:

MEAN = 8718.15
SIGMA = 52.73

How to bring this up?

1. System has to be in FLIR AUTO.
2. Roll the layers and bring the FLIR status field. (Upper right portion of the image).
3. Press the **LEVEL UP** button for at least 5 seconds.
4. The data will appear on the upper center of the IR image for 5 seconds, and will disappear automatically.

Usage: The value of the mean should be above 2000. If not increase integration time or select the next table.

13.2 Changing the LOS Maximum Rate.

You may change the maximum LOS rate at NFOV as follows.

13.2.1 FLIR Channel

Description: The maximum slew rate at NFOV is now 7.5 deg/sec and 24 deg/sec in MFOV. In addition there are three additional max rates, which can be used at NFOV only: 12, 18, 24.

At power up the system is set to use the 7.5.

Operation:

1. Long press (more than 5 seconds) on the IP/HH button will change the number to be 12 deg/sec. Note that at the first second of the press, the button will do what it is intended to do: If the system was in STOW it will go to INERTIAL. If it was in position or cage it will go to INERTIAL, etc…
2. After 5 second of press elapsed a legend **TF-E**, will start flashing on the upper right corner of the image to indicate that the system is NOT using the 7.5 default value. Also After 5 second of press elapsed, the

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AZ field will indicate the number 12 to echo that the 12 is used. The 12 will be displayed as long as the button is pressed and 5 seconds after it releases. Then the field will continue to display the normal payload AZ data.

3. The next long press on the IP/HH button will bring up to use the value of 18, while the next long press will bring the value of 24.

4. The next long press on the IP/HH button will bring back to use the default value of 7.5 and the TF-E will stop flashing. (7.5 will appear on the AZ data field for 5 seconds.)

13.2.2 DTV (EO) Channel

Description: The maximum slew rate at NFOV of 1.75 deg is now 7.5 deg/sec.

The following formula is used:

$$W = 7.5 \times 0.8 \times \frac{\text{CURRENT FOV}}{1.4\ (\text{Deg})} \times \frac{F}{127}$$

W = Current rate

F = Applied force on the JS

The maximum slew rate will reach the 60 deg/sec around 17 degrees. Below 1.75 deg the max rate will remain 7.5 (or the selected non-default value.)

Operation: Same as for the FLIR channel.

13.2.3 General

- ➡ You may scroll to new rate at any time and while being at any mode.
- ➡ This SW change is only for the turret.
- ➡ It is identified on the POP200 menu status as : **Version 12 dated 29 Jan 2004** or later.

13.3 System Standby

Description: The system has a protective "standby mode". In this mode the system gimbals are **fully operated** but locked in the STOW mode. Slice is in DTV mode and the FLIR is OFF (cooler is down). No control on the system or Symbology is available.

Purpose: The purpose of this mode is to protect the system in situations where it is not used (not under operation), but is installed on a craft or vehicle. The

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protection may be required, while the craft (or vehicle) are under non operational transport travel from one place to another.

Operation: Turn system to operate (ON). Wait 30 seconds for turret initialization to complete (end of TINI) and than revert back to STBY. The system will enter STANDBY.

SYSTEM STANDBY

13.4 Matching FOVs

Purpose: To indicate to the user, that the current DTV FOV is equivalent to the FLIR MED or NAR FOVs.

Description: Whenever the DTV zoom is within the following limits, a message will appear on the image upper right side (FLIR FOV status)

DTV FOV	Legend
21 - 23	WIDE
7.5 – 6.5	MED
2.1 – 1.7	NAR

Operation: N/A.

Usage: This data is for user information only.

13.5 Set LOS sector limits

Purpose: To prevent LOS movement while slewing to enter forbidden zoon.

Description: This is a system improvement to enable easier integration of the POP 200M/300M with the SHADOW200/400/600 UAVs.

Operation: Use the PCOM maintenance mode. Set three angles: YAW1 YAW2 and maximum elevation (MAXEL). If the difference between YAW1 and YAW2, is greater than 1 degree, this mode is active.

Now, while slewing, if the LOS reaches this limit, movement in that direction, will be halted.

Numbers are entered from 0 (forward) to 360. 180 is backwards.

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14 HCG Switches Assignment

Figure 14-1 is an illustration of the HCG switch assignments. The HCG P/N and S/N are also shown in the figure.

Note: Underlined text on the HCG indicates press action.

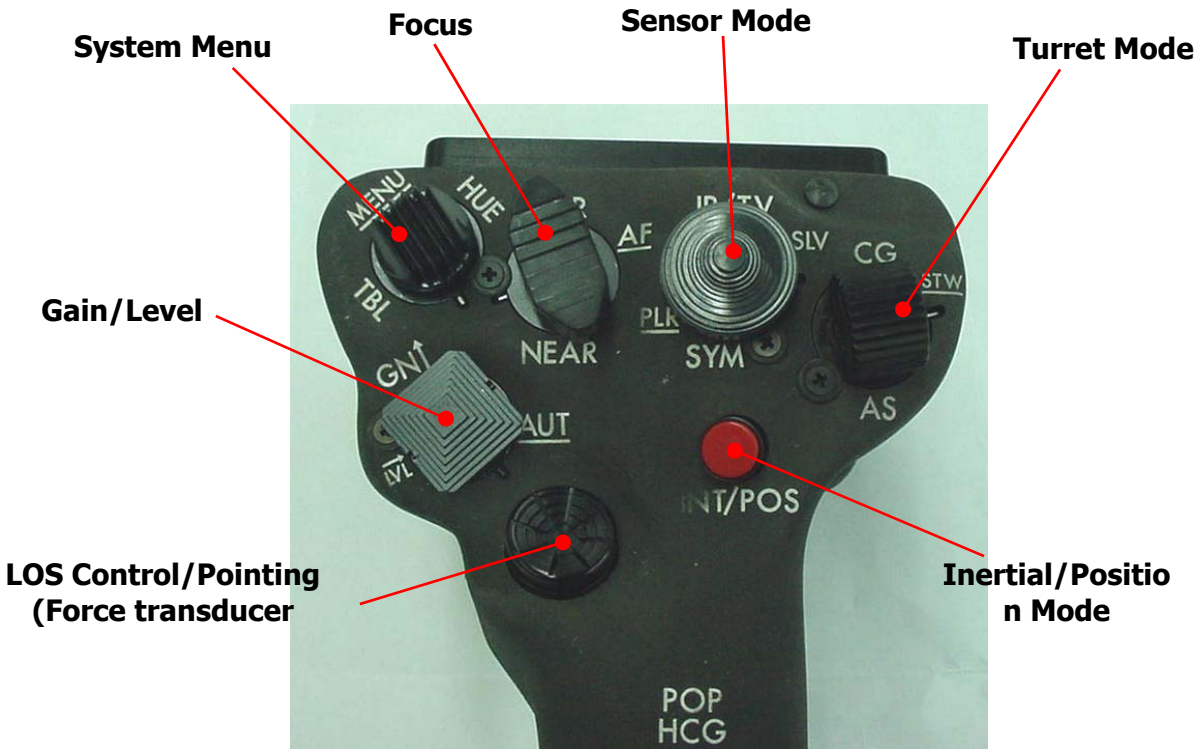

Figure 14-1. HCG Switch Assignments (sheet 1 of 2)

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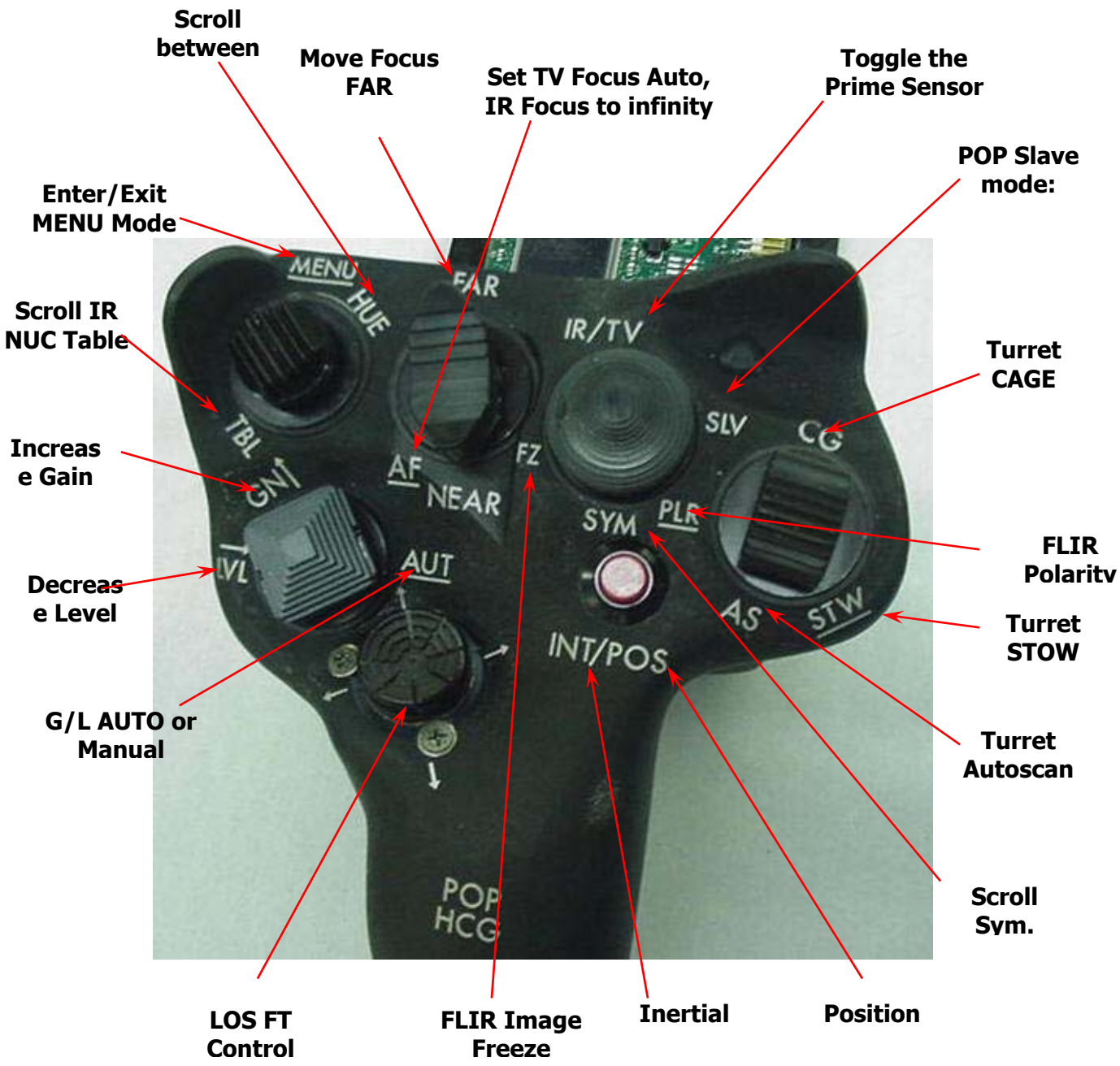

Figure 12-1. HCG Switch Assignments (sheet 2 of 2)

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Appendix A

Field Level Troubleshooting & Maintenance

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1. Introduction

1.1 General Description and Background

This section describes the requirements and the operations, which might be required in order to maintain the POP200 in the organization ("O") level (refer also as field level) of maintenance.

System operation in this level, is involved with the following setup:

- ➡POP200 system
- ➡28 Vdc power supplies to drive the payload.
- ➡Host controller to establish communication. (or a Hand Control Grip)
- ➡TV monitor to display the payload image.
- ➡Set of interconnecting cables.
- ➡Mechanical stand to carry the payload in the laboratory. This may be refers also to the carrying platform frame.

1.2 Before Reporting a Problem

As a general guideline, when you encountered a problem in the payload, first verifies that it is not a setup problem. Setup issues may be involved with proper input voltage level or polarity, or proper cables connections to the payload or to the monitors.

After that, isolate the source of the problem, in a subsystem level; Turret or Slice, or operating cable. Do so by replacing one of them, re-operating the system and duplicating the symptoms of the problem.

Note:

The payload has a test connector J2, which has a functional maintenance test channel. Never connect a device (especially a PC) to this port, unless you are familiar with all the parameters of this channel and know how to use this mode. Erroneous commands over this channel may corrupt the payload internal setup.

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1.3 Reporting a Problem

a. When reporting a problem, you may contact directly TAMAM's customer support department or TAMAM's local technical agent who is qualified to handle this matter.

b. Always record the turret and slice serial number. Also record the SW versions as they appear in the MENU system status.

c. To repair the system, send it to qualified laboratory. Some failures can be repaired at "I" (intermediate) level of maintenance, some at "D" (depot) level of maintenance.

1.4 After Replacing a Subunit

If you replace turret or slice, or if you disconnect and reconnect J1 cable then: Check general system integrity. Recycle powers to the system and verify basic operation:

➡Complete of initialization

➡FLIR image

➡DTV image

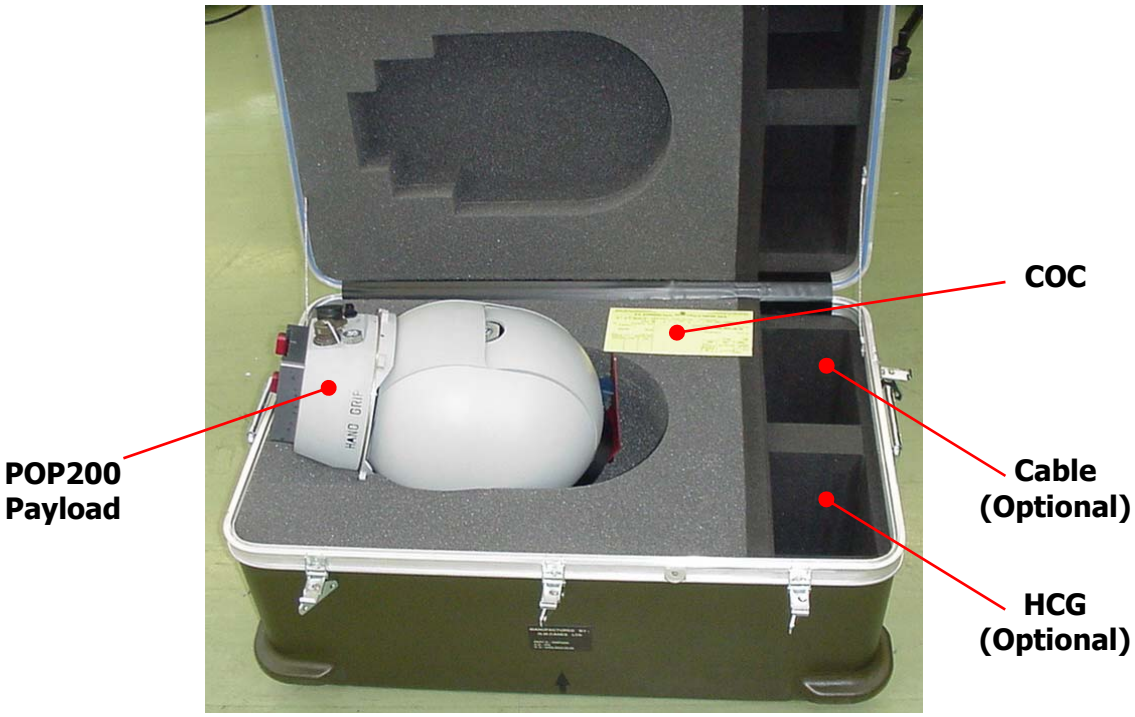

Figure A-1. POP200 Standard Package

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2. Removal/Installation of Slice from/to Turret

The following is a guideline to assemble and disassemble the slice from the turret.

2.1 Slice Removal

1. Install the POP on a stiff POP stand. Verify that J1, J2 are not connected.
2. Cover the slice lenses with the protective cover lenses (red color).
3. With one hand hold the slice in 0º elevation, with the second hand open the FOUR-HEX SCREW using 4mm or 5/32 200mm or 8" long hex screwdriver.
4. Release the four screws all the way out. Do not attempt to remove them out of their sockets. They remain part of the turret J22 J21 connectors.
5. Move the turret to 90º down so the slice front cover will pitch down, and slide out very slowly, the slice along its tracks.
6. Put the slice in a protective package.
7. Cover the turret and the slice connectors with cover.

2.2 Slice Installation

1. Install the turret on a stiff stand. Verify that J1, J2 are not connected.
2. Cover the slice lenses with the protective cover lenses (red color).
3. Check that the guidance hex screw on turret J22 and J21 are installed. If not install the screw and continue
4. Remove the cover from the connectors.
5. Verify that connector P22 (video) is connected to connector J22 and connector P21 (power) is connected to connector J21.
6. Move the connectors to 90º down.
7. Hold the slice with your two hands.
8. Locate the slice P21 connector versus turret J21 connector.
9. Slide in, the slice inside the turret path, along the two guiding tracks till you feel that a mechanical connection through J22-P22 and J21-P21, was established.
10. Hold the slice in 0º elevation.
11. Tight the FOUR-HEX SCREW using 4mm or 5/32 screwdriver.
12. Verify torque of 29 to 35 lb-in.

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13. Remove the lenses cover.
14. Check serviceability of the POP system.

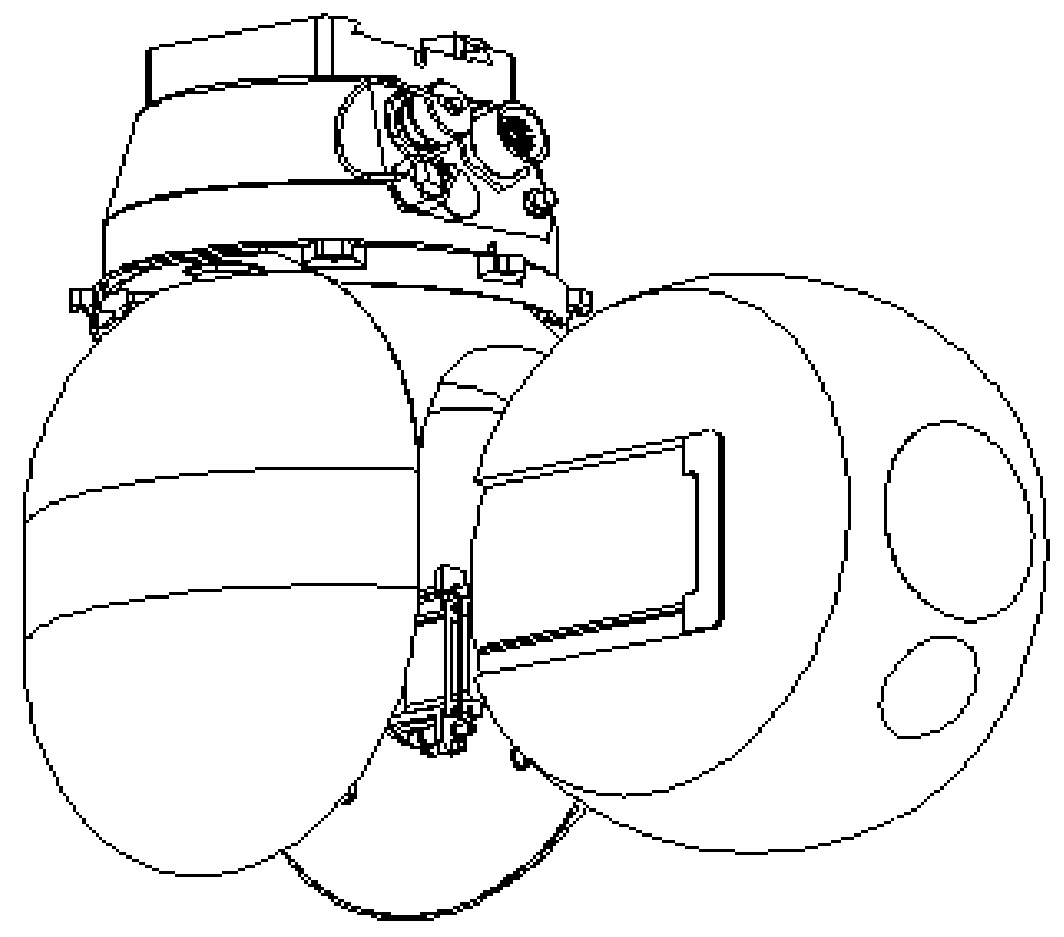

Figure A-2. Slice Removal and Installation

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3. System Routine Maintenance and Checkout

The POP200 does not required any periodically or scheduled preventive maintenance activities. Nevertheless the following activities are recommended to be performed on a mission basis:

a. **Cover:** If the payload is not operational or is stored, always use the red cover to cover and protect its windows. Make sure that you tied all four screws of the cover.

b. **Mounting:** Before trying to operate the payload, always mount it on a stiff and rigid stand. Connect it through its dive-tail or the 6 screws over the mounting ring.

c. **Cleaning:** Clean the payload windows when you observe dirt. Never use gloves, acetone or any other acid type of fluid to clean windows. You may harm the coating of the front lens. Use a clean soft towel. You may use wet towel with liquid soup. Alternatively you may use standard liquid for cleaning lenses.

d. **Purging and Removal of Moisture:** Check the humid indicator on the turret and on the slice. Use standard purging of the payload if the humid indicators, indicates the time for that comes. The recommended humid level should be below 40%. Blue color indicates the relevant percentage. See next for detailed purging procedure. Chapter 4 provides guide lines on purging.

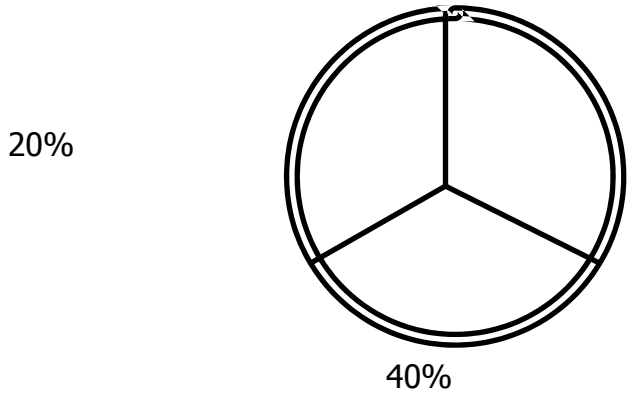

Figure A-3. POP200 Humidity Indicator

d. **System functional test:** If there is a need to perform a short check on the system, than chapter 5, provides guide lines on how to do this.

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4. System Purging

The following is a guide for system nitrogen purging. Upon due time you should purge the turret and/or the slice (note that each one of them is an independent sealed volume).

4.1 Required Materials

1. Nitrogen gas, (99.99% pure minimum), tank
2. Nitrogen pressure regulator with the secondary gage range is from 0 psi to 50 psi
3. Shredder valve adapter
4. Flexible pressure tubing ("Tygon tube") 2 meter (6 feet) X 6.35mm OD X 5.3 mm ID
5. Loctite 242
6. 5/32" Hex tip 8" long
7. Torque wrench
8. Philips screwdriver

✖ WARNING !

- **Nitrogen bottle stores pressure of up to 200 atmospheres (2900 psi). Ensure that Nitrogen bottle is in a vertical position and tied down. Ensure purging system is serviceable.**
- **Maximum temperature for purging is between 35°C (95°F) and 0°C (32°F).**
- **Ensure pressure regulator is installed and relief.**
- **Open Nitrogen valves slowly.**
- **Failure to comply can cause personal injury or death.**

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4.2 Procedure

1. Remove the slice from the Gimbals.
2. Open nitrogen valve slowly. (If the pressure in the bottle is lower than 50 ATM, or 725 PSI, than the nitrogen in the bottle is minimal. Refill the bottle).
3. Connect the "Tygon flexible tube" to the exit of the pressure regulator. Connect a Shredder valve adapter to the other end of the tube.
4. Calibrate the pressure regulator to 0.1 ATM (1.5 psi).
5. Open the Shredder valve adapter and verify nitrogen is flowing out of the pipe. Verify free movement of the valve. Using finger verify that the flow of nitrogen can be stopped.
6. Allow nitrogen to flow for 2 to 5 minutes, in order to purge the flexible tube, before connecting to the POP gimbals.
7. Reduce the pressure regulator to 0.07 ATM (1 psi).
8. Remove the plastic cap from the POP gimbals nitrogen shredder valve.
9. Connect shredder valve adapter to the POP gimbals shredder valve.
10. Remove the two Phillips screw on the side of the gimbals P/N MS 51957.
11. Gradually increase pressure up to 0.2 ATM (3 psi) trough regulator until pressure equalizer valve starts to evacuate Nitrogen, for 20 minutes minimum.
12. Apply LOCTITE 242 to the two screws. Replace the two Phillips screw, and torque to 19 ±2 lb-in. Check for smooth nitrogen flow through equalizer valve by depressing it. The valve will make a noise.
13. Gradually increase pressure up to 0.3 ATM (4.5 psi) and repeat the above verification. If the equalizer valve does not evacuate the nitrogen from the payload increase the pressure gradually (not to exceed 0.4 ATM or 6 psi) until the equalizer valve starts to evacuate nitrogen.

✖ CAUTION

Equalizer valve normally opens at 3-4 psi. If the valve does not open, either the valve is defective or leak exists in the POP gimbals.

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14. Allow the nitrogen to flow and check the humidify indicator. Humidity should be reduced to below 20%. Allow the Nitrogen flow for another period of time equal to the time that it took for the humidity indicator to fall from 30% to 20%.
15. Reduce the nitrogen pressure to 0.07 ATM (1 psi).
16. Disconnect the flexible tube from the POP gimbals valve and close it with the plastic cover.
17. Close the nitrogen bottle valve.
18. Reduce the nitrogen pressure to "0" pressure.
19. Disconnect the "Tygon tube" from the regulator and from the Shredder valve adapter.
20. Stow the purging equipment in dry and clean place.
21. Replace the slice on the gimbals and torque to 29 to 35 lb-in.
22. Perform field test or preflight test.

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5. Functional Test Procedure

5.1. Scope

The purpose of this document is to outline the steps that require to prove payload functional serviceability, prior to mission.
You may use this procedure while the payload is installed on board, as well as in the lab.
Use this also as a log paper to perform the test, if required.

5.2. General

a. This procedure may be executed by a qualified technician, who is familiar with the payload characteristics, and also with the details of the payload User's Manual guide.

b. This procedure should take less than 15 minutes.

c. If the payload configuration contains a **Laser Pointer** (LP) sensor, than you must follow the safety instructions for this sensor. See details in the POP200 User's Manual. As a reminder here is the LP safety highlights:

The Laser Pointer Sensor (LPS) is a non eye safe device, when is operated. As such, it may cause damage to the human eye when operated and pointed directly to the eye.

LPS generates an infra red optical spot on the target. The spot is in the non-visible band of 830 nanometer. Never try to operate the LPS in a non controlled manner, or for testing purposes. Never try to operate it for "just to see how the spot looks like".

Whenever you operate the payload, make sure that the legend

PTR - EN

Does not appear on the display. Its appearance indicates that the LPS is triggered and ready to fire.

✖ Caution

The LPS non-safe area is defined as a cone of ±5° around the payload center line of sight, and the range of up to 300 meters. Any human or animal being in this area, while the LPS fires, might be hurt.

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Functional Test Procedure and Results

✖ Caution:

Never power up the payload, unless it is properly secured to it mechanical mount.

Step	Action	Result	Record
1	Remove window cover and mark down the Payload serial number (if required)		
2	Turn the system to ON. Mark to yourself start up time (resolution of minutes)	HH : MM ___ : ___	
3	At the end of two minutes, verify the status of the turret as follows:	➡ CAGE ➡ Cooling bar decreases ➡ Proper time and day on the image is up and running.	
4	At the end of six minutes (after power up):	Appearance of FLIR scene image.	
5	Switch prime channel to DTV	Acceptance of DTV scene image.	
6	Switch to INERTIAL and slew the payload LOS left and right to complete approximately 90°	LOS moves accordingly.	
7	Complete azimuth 360° turn:	Verify proper display on the azimuth bar.	
8	Slew in elevation in the range of –110° to +40°	Verify proper display on the image elevation bar.	
9	Press the INT/POS for at least 4 seconds to enter turret IBIT.	Verify that the turret completes IBIT and ends at CAGE position.	
10	You are at DTV. Select a random stationary target to be		

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Step	Action	Result	Record
	displayed.		
11	Press zoom control up to X16	Image increases accordingly.	
12	Switch prime channel to FLIR.	➡ FLIR image scene. ➡ WFOV. ➡ AUTO.	
13	Check for FLIR image quality	➡ Good image ➡ No vertical lines. ➡ Bad pixels may appear, but few.	
14	Move focus control end to end.	Focus mark on image, moves accordingly.	
15	Focus the image on any available near target.	Target is focused.	
16	Switch FLIR to MFOV	FOV is switched to MFOV.	
17	Switch FLIR to NFOV	FOV is switched to NFOV.	
18	Switch FLIR to WFOV	FOV is switched to WFOV.	
19	Slew the LOS toward a random stationary contrasted target. Lock the video tracker onto the target.	Lock is stable on the stationary target. Image is stable. Wait 10 seconds. Release the lock.	
20	For LRF: Point the LOS toward a scene, which is 200 meters or more, far.	Range out. On the image you should get a number for range or dashes for no range.	
21	Turn system power to OFF	No image.	
22	If required, Install back the window cover. Verify that J2 connector is caped.		
23	Record in the platform logbook the completion of this functional test.		

Test Location	
Date	
Name	

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6. System Troubleshooting

If you have failure in one of the sensors – switch to the other sensor and check if the same failure appears on the other sensor as well. For example if the FOV in the FLIR is not change check if the ZOOM in the DTV is working.

No.	Symptom	Probable Cause	Recommended Action
1	Payload is not active, while 28v power is valid. Current measurement on the PSU monitor is zero.	a. 28VDC wire, is disconnected in the cable	Check continuity of the high and low signals between the PSU and P1 connector.
		b. PSU is set to low input voltage. Less than 24VDC.	Set input voltage to higher value (more than 24VDC).
		c. Voltage supply cable is too long. Considerable voltage drops along the line.	Check input voltage at J1 terminals. It should be more than 24VDC. Note: This measurement should be done while the payload is connected.
		d. Power Supply Unit sense terminals (if applicable) are not connected to the output voltage terminal.	Connect +sense to HI, and –sense to LO.
2	Payload is not active, does not respond to commands, while 28v power is valid. Current measure- ment on the PSU monitor is Normal.	Lack of communication controller to payload. Note: If there is FLIR image, verify that the cooling bar is full black. That indicates lack of communication controller to turret or turret to slice.	a. Check communication-wiring continuation. b. Check matching of communication polarity: HI drives to HI receive. LO drive to LO receive. c. Check that payload enters backup mode 30 seconds after applying power.
3	At power-up, lack of typical FLIR cooler noise.	a. Faulty cooler in the slice	Replace slice. Send to "D" level for repair.
		b. Slice is not mounted mechanically properly within the turret J21, J22.	Check for a good mechanical connection of the slice to the turret.
4	Payload completes initialization, but does not transfer control to the	Lack of communication between host controller (or HCG) and turret.	Check that communication to the payload complies with the requirements of the protocol.

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No.	Symptom	Probable Cause	Recommended Action
	host. Enters backup mode.		
5	Payload does not complete initializa- tion. SINI remains and cool-down bar remains full:		
	Case a: Cooler noise reduces power	Lack of communication between turret and host of between turret and slice.	Check POP operating cable. If OK, replace slice.
	Case b: Cooler noise maintains full power	FLIR cooler malfunction.	Replace slice. Send to "D" level for repair.
6	Payload generates mechanical noise, friction and vibrates, while there are no external vibration.	a. The payload installation to the carrying plate is not stiff enough.	Make sure that the stand, which carries the payload, is stiff enough.
		b. The slice is not mounted properly within the turret.	Verify that the 4 screws of the slice are screwed properly.
7	Legend **FT- P** flashing on the upper right of the display.	External input voltage too high (above 32VDC) or too low (below 29VDC)	Tune input voltage.
	Cool down black bar, remain full. FLIR image appears, but there is no control on FLIR nor on TV	Lack of communication with the slice.	Replace the slice.
8	Payload LOS drives independent of host commands. Stuck in up position, or spins fast in the yaw direction. (Slice completes initialization)	Turret AZ or EL potentiometers are faulty.	Replace turret. Send to "I" level for repair.
9	Lack of symbology on the FLIR **and, or** the DTV images.	a. You are monitoring the "secondary" output video.	Connect the "prime" video output to the monitor.
		b. The user, using a "long polarity" command removed symbols.	Use the "long polarity" command, to bring back symbology.
10	FLIR does NOT change FOVS. All other FLIR commands are	Mechanical lock of the FLIR FOVs mechanism.	Replace slice. Send to "D" level for repair.

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No.	Symptom	Probable Cause	Recommended Action
	responding.		
11	Too many bad pixels or "stains" in the FLIR image.	Input voltage to the payload is too low, below 24VDC.	Increase input voltage. If this is not possible, perform external one point NUC, using the procedure of 7.10.
12	FLIR image, exhibit a "veil" or a "net" over its image.	The temperature of the scene has changed significantly from the time when the image was OK.	a. Select another NUC table. b. Or perform external one point NUC, using clear sky as a target.
		User has change integration time significantly from the original setting. User has changed table with no need to do so.	a. Tune back the integration time. b. Or perform external one point NUC, using the procedure of 7.10.
13	FLIR image does not appear. Continues FLIR gray scale pattern. Cooler continu- ously running at full speed.	FLIR cooler loop does not closes. Cooler failure.	Replace slice. Send to "D" level for repair.
14	FLIR image does not come and cooler slows down, indicating its reaches the required cold temp of the dewar.	Slice controller reads a faulty FLIR detector temperature. Does not allow transferring image control to the detector.	Replace slice. Send to "D" level for repair.
15	Black bar of FLIR cool downs time indicator, stays full and does not shrinks.	Lack of internal communication between the slice and the turret.	Replace slice and recheck. If problem continues then the turret communication failed. Else slice communication failed. Replace turret. Send to "I" level for repair. Else, send slice to "D" level for repair.
16	TV Channel does not respond to user commands.	Fail of TV channel internal communication	Replace slice. Send to "I" level for repair.
17	TV image is locked in pixel position: WFOV, or saturated/dark image.	Fail of the DTV channel.	Replace slice. Send to "I" level for repair.

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No.	Symptom	Probable Cause	Recommended Action
18	System LOS drifts in a rate, which is above normal.	You may have installed a new slice.	Drift calibration can be done in the field using a maintenance kit. Please consult TAMAM or send the system to "I" level of maintenance.
		System is not mounted properly to its carrying frame.	Verify proper and rigid mounting of the payload.
19	System tracker fails to lock on a target.	Target is not contrasted enough	Try to lock on a contrast target.
20	System fails to slave to RADAR	Radar is not transmitting data to POP	See if HDG appears on image. Check RADAR integrity.

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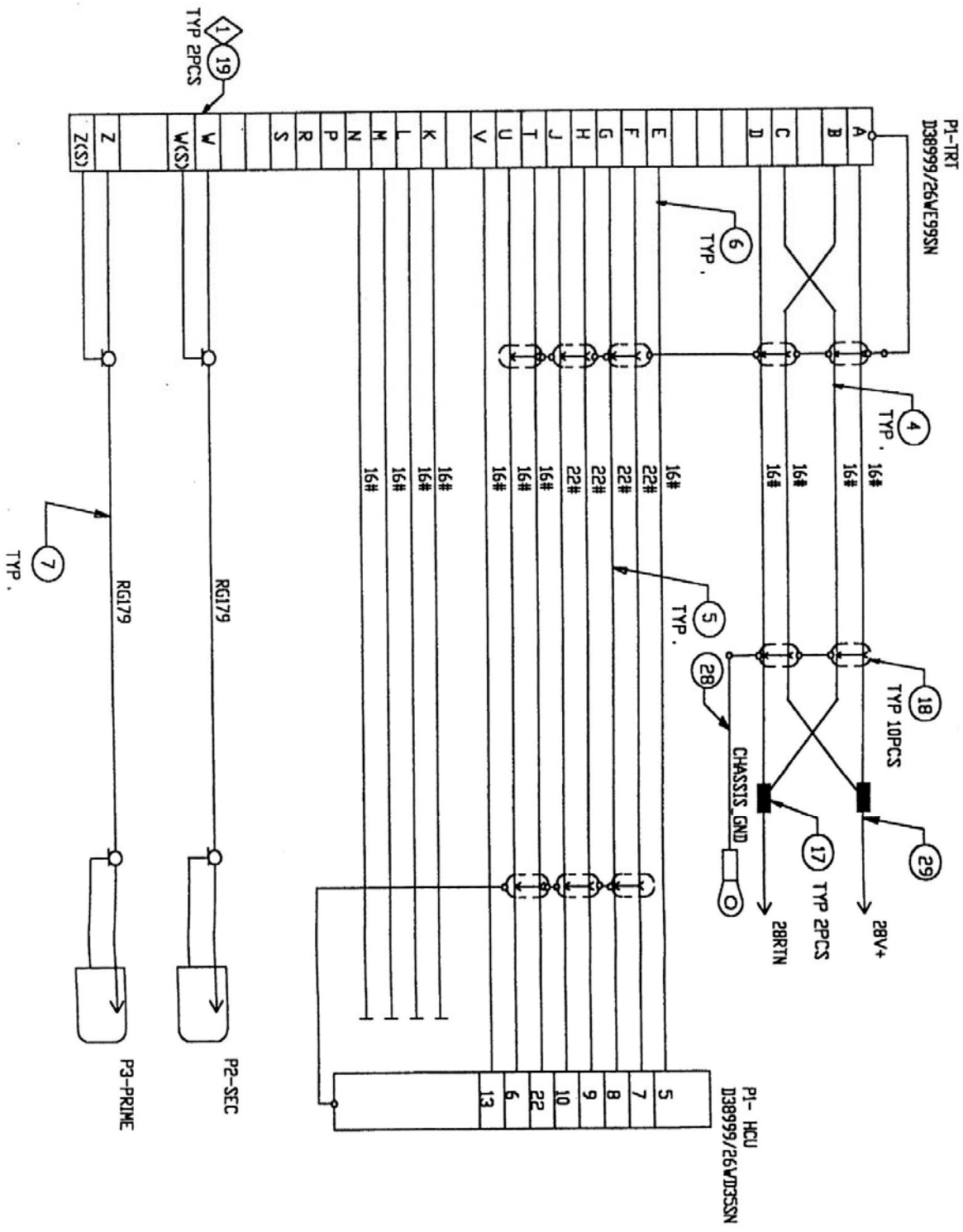
Appendix -B-
POP200 Standard operating cable W1 / W1L

TAMAM P/N 8520.8510.00.00 6 meter length
TAMAM P/N 8520.8512.00.00 14 meter length

Electrical drawing



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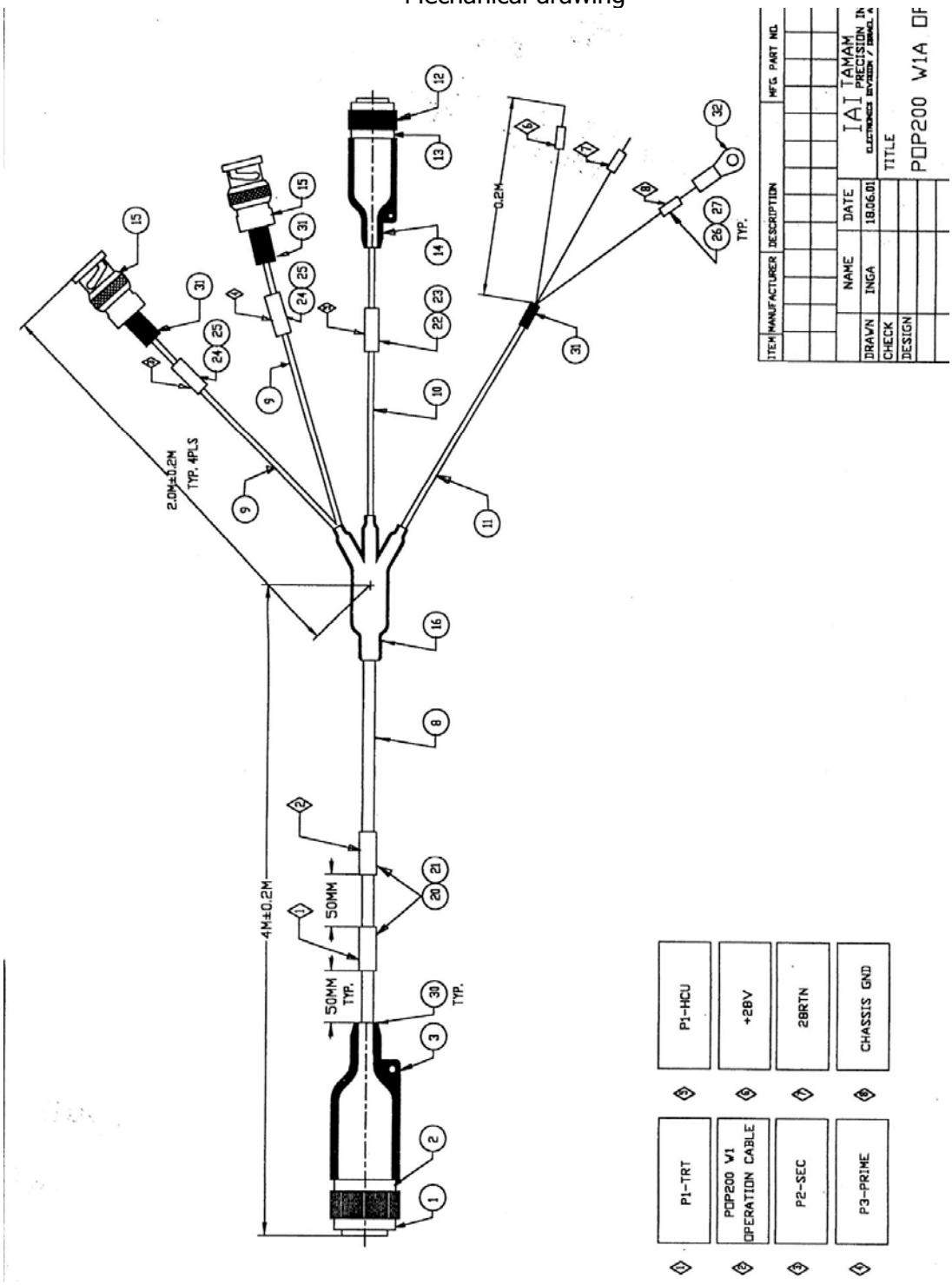
Mechanical drawing



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Recommended part list for Cable

32	RAYCHEM	TERMINAL LUG	ORD-7728778	1PC	
31	RAYCHEM	HE.SH.SL.	ATUM-9/3-0	0.12M	
30	RAYCHEM	ADHESIVE	S-1125	A.R.	
29	RAYCHEM	SINGLE WIRE-RED	44A0111-16-2	0.2M	
28	RAYCHEM	SINGLE WIRE BLACK	44A0111-16-0	0.2M	
27	RAYCHEM	HE.SH.SL.	RT-375-1/8-X	3PCS	
26	RAYCHEM	HE.SH.SL.	TMS-SCE 1/8-9	3PCS	
25	RAYCHEM	HE.SH.SL.	RT-375-1/4-X	2PCS	
24	RAYCHEM	HE.SH.SL.	TMS-SCE 1/4-9	2PCS	
23	RAYCHEM	HE.SH.SL.	RT-375-1/2-X	1PC	
22	RAYCHEM	HE.SH.SL.	TMS-SCE 1/2-9	1PC	
21	RAYCHEM	HE.SH.SL.	RT-375-3/4-X	2PCS	
20	RAYCHEM	HE.SH.SL.	TMS-SCE 3/4-9	2PCS	
19	RAYCHEM	COAXIAL SOCKET	D602-0141	2PCS	
18	RAYCHEM	SOLDER SLEEVE	S0103R	10PCS	
17	RAYCHEM	SPLICE	D346-38	2PCS	
16	RAYCHEM	TRANSITION	462A023-25	1PC	
15		CONNECTOR BNC	31-242	2PCS	
14	RAYCHEM	BOOT	202K142-25	1PC	
13	SUNBANK	ADAPTER	S3332FM6910-34-6	1PC	TXR40AB00-1410AI
12		CONNECTOR	D38999/26WD35SN	1PC	
11	RAYCHEM	JACKET SLEEVE	DR-25 3/8-0	2M	
10	RAYCHEM	JACKET SLEEVE	DR-25 1/2-0	2M	
9	RAYCHEM	JACKET SLEEVE	DR-25 3/16-0	4M	
8	RAYCHEM	JACKET SLEEVE	DR-25 3/4-0	4M	
7		COAX	RG179	28M	
6	RAYCHEM	SINGLE WIRE	44A0111-16	42M	
5	RAYCHEM	TW.WIRIS & SHIELD	44A1121-22	14M	
4	RAYCHEM	TW.WIRIS & SHIELD	44A1121-16	21M	
3	RAYCHEM	BOOT	202K153-25	1PC	
2	SUNBANK	ADAPTER	S3332FM7012-34-6	1PC	TXR40AB00-1612AI
1		CONNECTOR	D38999/26WE99SN	1PC	
					A.L.T.

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J1 - Pins Assignment.

	SIGNAL NAME	SOURCE	DESTINATION
A	+ 28V	28V PWR BUS	TURRET
B	+ 28V	28V PWR BUS	TURRET
C	28VRTN	28V PWR BUS RTN	TURRET
D	28VRTN	28V PWR BUS RTN	TURRET
E	PWR ON/OFF	HCG or Host	TURRET
F	HCG RX Hi	TURRET	HCG or Host
G	HCG RX LO	TURRET	HCG
H	HCG TX Hi	HCG or Host	TURRET
J	HCG TX LO	HCG	TURRET
K	RESERVED	TURRET	
L	RESERVED	TURRET	
M	Spare	NOT CONNECTED	
N	Spare	NOT CONNECTED	
P	RESERVED	TURRET	
R	RESERVED	TURRET	
S	Spare	NOT CONNECTED	
T	28VDC	TURRET	HCG
U	28V RTN	TURRET	HCG
V	CHASSIS	AIRFRAME CHASSIS	TURRET/ HCG
W	Analog Video – Secondary Channel. Video RTN	TURRET (Coax pin)	Video Monitor
X	SPARE		
Y	SPARE		
Z	Analog Video – Prime Channel. Video RTN	TURRET (Coax pin)	Video Monitor

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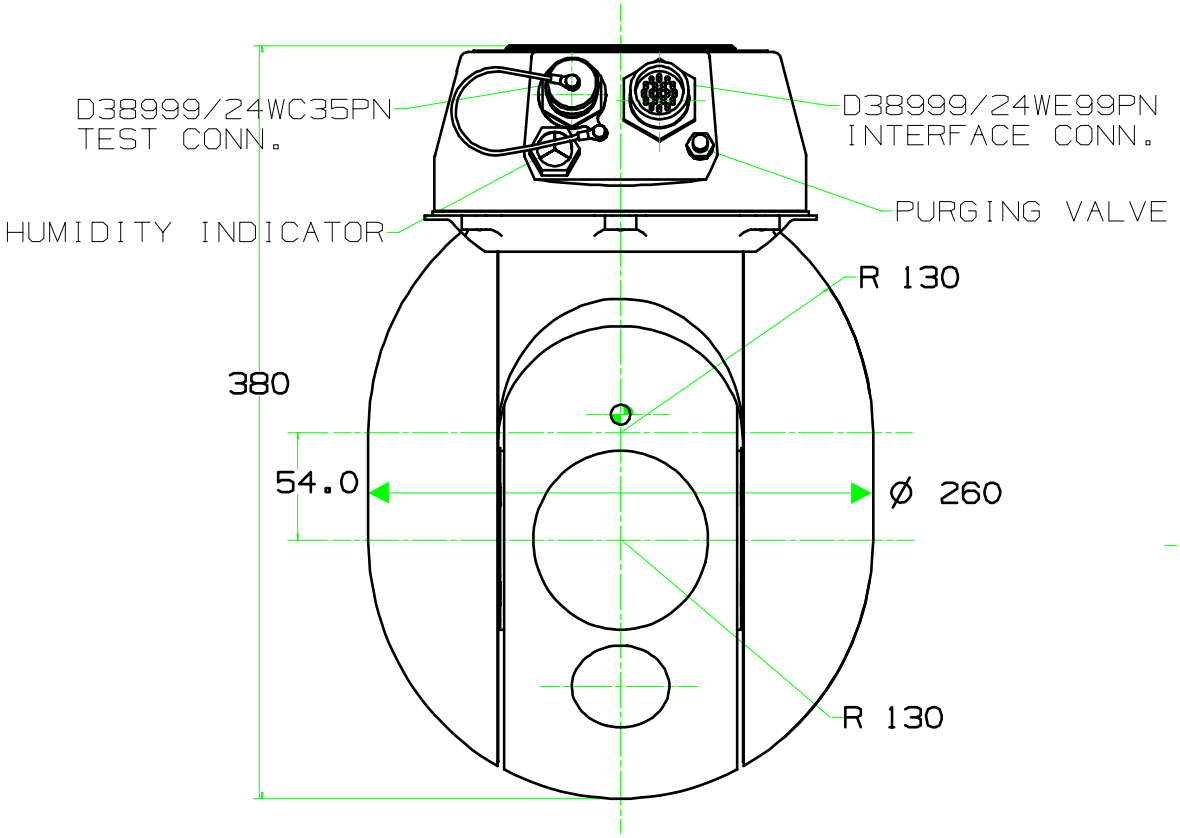
Appendix -C-
POP200 General Characteristics

1. General Dimensions



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2. FLIR General characteristics.

- Cool down time : Less then 6 minutes (typical).
- Two points or one point non uniformity correction (NUC) : Automatic by means of internal diffuser. Manual by using external diffuser. Less then one minute.
- Three preprepared NUC tables, user selectable, for different scene scenario.
- Read out: Snapshot, Indium bump.
- Exposure time : 0.8- 7.0 milliseconds, user selectable.

3. FLIR:

a. Spectral range 3 - 5 μm
b. Number of detector pixels 320 x 240 InSb type.
d. Fields of View (FOVs):
(1) Wide FOV (H x V) 22° x 16° FL : 25mm
(2) Medium FOV (H x V) 6.90° x 5.20° FL : 80mm
(3) Narrow FOV (H x V) 1.72° x 1.29° FL : 320mm
(4) Super Narrow (H x V) 0.8° x 0.65°
e. Cooling system closed-cycle, split , minirotary Stirling cryocooler

4. The standard DTV: Characteristics and Parameters.

	Characteristics	Parameter
a.	CCD:	1/4", color
b.	Modes of operation	
	TV color:	AE-Shutter priority
	Min. Illumination:	1.0 Lux for color mode.
c.	Number of pixels:	768 x 576 (NTSC), 752x582 (PAL), effective
d.	Focus:	Automatic at all FOVs/ Manual control. (User selectable)
e.	Iris:	Automatic
f.	Shutter:	Automatic / Manual. (user selectable 1/60 to 1/10,000).
g.	Gain:	Automatic.
i.	Focus to infinity	Yes (one push)
k.	F#	3.2
l.	Zoom Ratio:	1 : 16 Optic, 16 : 32 Electronic.
m.	FOV (continuous zoom)	27.8° - 1.74°, Optical (horizontal). 1.74° - 0.85°, Electronic (horizontal).

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5. The Enhanced DTV: Characteristics and Parameters.

	Characteristics	Parameter
a.	CCD:	1/6", color
b.	Modes of operation	
	TV color:	(1) AE Full, (2) AE-Shutter priority, (3) AE-Speed priority, (4) Manual.
	Near IR*:	Yes, Open band pass 0.4 to 1.0 micron with BW image (1) AE Full, (2) AE-Shutter priority, (3) AE-Speed priority, (4) Manual.
	Min. Illumination:	2.5 Lux for color mode. 0.05 Lux. When using NIR (Near IR*) for monochromatic mode
c.	Number of pixels:	NTSC: 916 x 687 Picture elements
d.	Focus:	Automatic at all FOVs/ Manual control. (User selectable)
e.	Iris:	Automatic / Manual. (user selectable F1.6 to F28)
f.	Shutter:	Automatic / Manual. (user selectable 1/60 to 1/10,000).
g.	Gain:	Automatic.
h.	Over / Under Exposure	Yes. Automatic or Manual control
i.	Focus to infinity	Yes (one push)
j.	Image freeze	Yes
k.	F#	1.6 – 2.7
l.	Zoom Ratio:	1 : 22.5 Optic, 22.5 : 45 Electronic.
m.	FOV (continuous zoom)	22.5° - 1.0°, Optical (horizontal). 1.0° - 0.5°, Electronic (horizontal).

* The near IR (NIR) function automatically control to achieve sensitivity to Near-infrared range (up to 1.0 micron) in low light environments, or after sunset, extending duration range of the DTV/CCD sensor.
This mode is very useful in special low light environment such as early dawn, after sun set, or streetlights. During night operation it maybe be used as a complementary source of data to the main FLIR sensor.

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